B.TECH. CURRICULUM

ACADEMIC YEAR: 2024–25

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING (INTERNET OF THINGS)

Undergraduate Rules and Regulations-2024 (URR24)
In accordance with the National Education Policy 2020
w.e.f AY 2024-25

Regulations Governing the
Choice Based Credit System and
Multiple Entry and Multiple Exit Options
with
Competency-Focused Outcome Based Curriculum (CF-OBC)

KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE, WARANGAL – 506 015 TELANGANA

(UGC Autonomous Institute Under Kakatiya University, Warangal

I SEMESTER

Stream - II

S. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	C
-	IKSC	U24IK100	AICTE Mandated Student Induction Programme (Universal Human Values - I)						-
1	BSC	U24MH101	Differential Calculus and Ordinary Differential Equations	2	1	-	6	9	3
2	BSC	U24CY102B	Engineering Chemistry	2	1	2	5	10	4
3	ESC	U24CI103	Digital Logic Design	2	1	-	4	7	3
4	ESC	U24IN104	Programming for Problem Solving with C	2	1	2	5	10	4
5	HSMC	U24MH105	English Communication and Report Writing	2	-	-	3	5	2
6	VAC	U24VA106	Sports & Yoga	-	-	2	2	4	1
7	ESC	U24ME107	Engg. Graphics & CAD*	-	-	2	2	4	1
8	ELC	U24EL108	Practicum-I	-	-	-	4	4	1
9	VAC	U24VA109XXXXX	SEA – I / SAA-I	-	-	-	2	2	1
10	AEC	U24AE110	Expert Talk Series-1	-	-	-	1	1	1
Total:				10	4	8	34	56	21
Summer/ Inter-semBridge Courses (Approved by BoS and Dean,AA): 1 week to 10 days: 1 credit to each Bridge course under additional learning (will be printed on grade sheet)									

*** For CE and ME, it will be a three (03) credit (1-0-4) course on Engineering Graphics & Design (Pedagogy: Sessions with conventional drafter andCAD). (For CE: U24CE107/U24CE207 and for ME: U24ME107A/U24ME207A)**

Pool – III (Chemistry)		
S. No.	Course Code	Course Title
1.	U24CY102A	Engineering Chemistry *(for Mechanical Engineering)*
2.	U24CY102B	Engineering Chemistry *(Common to CSM, CSD, CSN, CSO & IT)*

DIFFERENTIAL CALCULUS AND ORDINARY DIFFERENTIAL EQUATIONS			
Class: B.Tech. I -Semester		**Branch:** Common to all branches	
Course Code:	**U24MH101**	**Credits:**	**3**
Hours/Week (L-T-P-O-E):	**2-1-0-6-9**	**CIE:**	**60 %**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40 %**

Course Learning Outcomes (COs):

After completion of this course, the students should be able to…

CO1: examine the convergence of a series and interpret mean value theorems.

CO2: apply partial differentiation to functions of several variables in solving various engineering problems.

CO3: apply appropriate methods of differential equations of first order and first degree to solve real life engineering problems.

CO4: analyze the solutions of higher order linear differential equation with constant coefficients

UNIT-I	**UNIT-I**

Infinite Series: Sequences, Series, General properties of series, Series of positive terms, Comparison tests-Limit form, Integral test, D'Alembert's Ratio test, Cauchy's root test

Differential Calculus and its applications: Fundamentaltheorems-Rolle's theorem (Geometrical interpretation), Lagrange's mean value theorem (Geometrical interpretation), Cauchy's mean value theorem, Taylor's theorem (Generalized mean value theorem), Expansions of functions- Maclaurin's series, Taylor's series, Maxima and Minima-Conditions, Practical problems (rectangle, right circular cylinder, cone)

Self-Learning Topics (SLTs):*Review of basic concepts of limit, continuity and differential ability [Reference 1: topic (3.1,3.2,3.5,4.1)]*

Alternating series [(Text 1: topic 9.12, Solved problems: 9.16,9.17, Practice problems: exercise9.7(1, 7)]

Additional problems on fundamental theorems [(Text1: topic4.3, Solved problems: 4.13(i),4.14,4.17, Practice problems:exercise4.4 (1(i),1(ii), 3(ii), 10(i), 10(ii))]

Additional problems on Maclaurin's series [(Text1: topic 4.4, Solved problems: 4.20, Practice problems: exercise 4.5 (3, 5)]

UNIT-II	**UNIT-II**

Partial differentiation and its applications: Functions of two or more variables, Partial derivatives, Total derivative, Change ofvariables,Jacobians, n Functional relationship, GeometricalInterpretation-Tangentplane and Normal to a surface, Taylor's theorem for function of two variables (without proof),Errors and approximations, Total differential, Maxima and minima of functions of two variables, Lagrange's method of undetermined multipliers, Differentiation under the integral sign

Self-Learning Topics (SLTs):

Leibnitz rule of Differentiation under the integral sign for variable limits [(Text 1: topic 5.13(2)), Solved problems: 5.54, Practice problems:exercise 5.11 (1)]

Additional problems on maxima and minima of function of two variables [(Text1: topic 5.11 (1), Solved problems: 5.42, 5.43, Practice problems:exercise 5.10 (1(i),1(ii),1(iii))]

Additional problems on Lagrange's methods of undetermined multipliers [(Text1: topic (5.12), Solved problems: 5.45, 5.48, Practice problems: exercise 5.10 (3(i) ,3(ii))]

UNIT-III	**UNIT-III**

Differential equations of firstorder (DE): Reorientation of differential equation of firstorder

and firstdegree (Formation a differential equation, variables separable method, homogeneous equations, Linearequations),Exact differential equations, Equations reducible to exact equations,

Applications of differential equations of firstorder: Orthogonal trajectories - Orthogonal trajectoriesof the family of curves f(x, y, c)=0, Physical applications-Motion of a boat across a stream, Resisted motion, Velocity of escape from the earth, Simple electric circuits - RL series circuit, Newton's law of cooling, Rate of decay of Radio-active materials, Rate of growth of population

Self-Learning Topics (SLTs): *Review of DEs of first order (Text 1: topic 11.1, 11.2, 11.3, 11.4,11.5)*
Solutions of Non-exact DEs by Inspection Method [(Text 1: topic 11.12(1), Solved Problems: 11.30, Practice problems: exercise 11.8(1,3)]
Additional problems on Non-exact DEs[(Text1: topic11.12(2,3,4,5), Solved problems: 11.33,11.35,11.36, Practice problems: exercise 11.8(9,15)]
Orthogonal Trajectories of family of curves in polar coordinates [(Text1: topic 12.3(3), Solved problems :12.7,12.8 ,Practice problems: exercise 12.2(9,10)]

UNIT-IV	**UNIT-IV**

Linear differential equations: Lineardifferentialequationswithconstantcoefficients, Rules for finding complementary function, Inverse operator, Rules for finding the particular integral($Q=e^{ax}$, sin(ax+b) or cos(ax+b), $x^m$and $e^{ax}V(x)$),Methodofvariationofparameters, Linear dependence of solutions

Applications of linear differential equations: Simple harmonic motion, Simple pendulum, Oscillations of spring, Oscillatory electrical circuit-LCR circuit, Electro-mechanical analog

Self-Learning Topics (SLTs):
Finding the particular integral of $Q(X) = X^m V(X)$[(Text 1: topic 13.7, Solved problems: 13.16,13.17,13.19, Practice problems: exercise 13.2 (21,22)].
Additional problems on method of variation of parameters [(Text 1: topic 13.8(1), Solved problems: 13.25, 13.26, Practice problems: exercise 13.3(1,5)]
Cauchy's homogeneous linear differential equation [(Text 1: topic 13.9(1), Solved problems: 13.31,13.34, Practice problems: exercise 13.4(3,6,9)]

Textbook:

1. Grewal, B.S.,*Higher Engineering Mathematics*, Khanna Publishers, Delhi, 44th edition, 2017

Reference Book(s):

1. Shanti Narayan, Dr. Mittal P.K, *Differential Calculus*, S. Chand & Co., New Delhi, 1stedition, Reprint 2014
2. Kreyszig E, *Advanced Engineering Mathematics*, Inc, U.K, John wiely & sons, 10th edition, 2020
3. S.S. Sastry, *Engineering Mathematics, Vol.II,* Prentice Hall of India, 3rd edition, 2014.

Web and Video link(s):

1. https://youtu.be/4EYko9rdF7g?si=WUu12*NPTEL Video Lecture on Infinite seriesby Prof. S.K.Ray, Professor of Mathematics, IITK Kanpur.*
2. https://youtu.be/0apMXhWG_W8?si=M-abw2Gq3buX5HLM*NPTEL Video Lecture on Fundamental mean value theorems by Prof. Jithedra Kumar, Professor of Mathematics, IITK Kharagpur.*
3. https://youtu.be/6r5jfT8xrXM?si=ryLXYVJr4-iUkdlV, *NPTEL Video Lecture on Exact Differential Equations, Prof. Jithedra Kumar, Professor of Mathematics, IIT Kharagpur.*
4. https://youtu.be/kbGhrqV9AOM?si=yGyK_V7kJKGa3OaR*NPTEL Video Lecture on Orthogonal Trajectories of family of curvesby Prof. Aditya Sharma, Professor of Physics, IISE*

Bhopal.

5. *https://youtu.be/btOCUmJkrrg?si=zq3nB00kplm7b5se, NPTEL Video Lecture on Higher Order Linear Differential Equations, Prof. Jithedra Kumar, Professor of Mathematics, IIT Kharagpur.*

Course Articulation Matrix (CAM):		**U24MH101 DIFFERENTIAL CALCULUS AND ORDINARY DIFFERENTIAL EQUATIONS**												
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	**U24MH101.1**	2	2	1	1	-	-	-	1	1		1	2	2
CO2	**U24MH101.2**	2	2	1	1	-	-	-	1	1		1	2	2
CO3	**U24MH101.3**	2	2	1	1	-	-	-	1	1		1	2	2
CO4	**U24MH101.4**	2	2	1	1	-	-	-	1	1		1	2	2
U24MH101		**2**	**2**	**1**	**1**	**-**	**-**	**-**	**1**	**1**		**1**	**2**	**2**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	examine the convergence of a series and interpret mean value theorems	SDG 4	Quality Education	Develops mathematical reasoning and analytical skills essential for engineering education
CO2	apply partial differentiation to functions of several variables in solving various engineering problems	SDG 9	Industry, Innovation and Infrastructure	Applies mathematical techniques to solve engineering problems that support innovation and technological development
CO3	apply appropriate methods of differential equations of first order and first degree to solve real life engineering problems	SDG 9	Industry, Innovation and Infrastructure	Uses mathematical modeling to address engineering challenges and develop sustainable technological solutions
CO4	analyze the solutions of higher order linear differential equations with constant coefficients	SDG 4, SDG 9	Quality Education; Industry, Innovation and Infrastructure	Enhances analytical problem-solving skills and supports engineering applications through mathematical modeling

ENGINEERING CHEMISTRY			
Class: B.Tech. I Semester		**Branches:**CSM, CSD, CSN, CSO & IT	
Course Code:	**U24CY102B**	**Credits:**	**4**
Hours/Week (L-T-P-O-E):	**2-1-2-5-10**	**CIE:**	**60%**
Total Number of Teaching Hours:	**60 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1 apply the concepts of electrochemical energy systems for batteries and fuel cells

CO2 interpret suitable techniques of water analysis and corrosion treatment of solid materials

CO3 apprise manufacturing of engineering materials and spectroscopic techniques of chemical analysis

CO4 apprise the synthesis, applications of engineering materials and principles of green chemistry

CO5 determine water quality parameters-alkalinity, hardness

CO6 make use of analytical instruments for chemical analysis

CO7 determine metals present in their ores

CO8 design the synthesis of nanomaterial and polymer

UNIT-I	9 Hrs

Electrochemical Technology and Engineering: Introduction, Specific conductance, Equivalent conductance, Effect of dilution, Conductometric titrations-Acid base titrations-Strong acid vs strong base, Strong acid vs weak base, Weak acid vs strong base, Weak acid vs weak base, Advantages of conductometric titrations, Galvanic cell, Electrode potential, Electrochemical series, Nernst equation, Potentiometric titrations-Acid base titrations and advantages of potentiometric titrations

Batteries: Classification, Lead-acid battery, Li-ion battery

Fuel cells: Hydrogen-oxygen fuel cell

Self Learning Topics (SLTs): *Types of conductors (Text 1: Jain &Jain: chapter 5 topic 1), Ohms law (Text 1: Jain & Jain: chapter 5 topic 5)*

UNIT-II	9 Hrs

Applied Chemistry:

Water Technology: Introduction, Hardness of water, Estimation of hardness of water by complexometry, Alkalinity, Determination of alkalinity, Numerical problems. Determination of dissolved oxygen (DO), Biochemical oxygen demand (BOD), Chemical oxygen demand (COD), Softening methods-Ion exchange method, Desalination processes, Reverse osmosis, Quality parameters of potable water (BIS and WHO)

Corrosion: Introduction, Dry corrosion, Pilling-Bedworth rule, Wet corrosion, Factors effecting corrosion-Purity of the metal, Relative areas of anodic and cathodic parts, Nature of surface film, Humidity, pH and Temperature, Prevention methods of corrosion-Cathodic protection-Impressed current cathodic protection, Sacrificial anodic protection

Self Learning Topics (SLTs): *Units of hardness (Text 1: Jain &Jain chapter 1 topic 5), Introduction to corrosion (Text 1: Jain & Jain: chapter 7 topic 1)*

UNIT-III	9 Hrs

Engineering Materials: Nanomaterials-Introduction, Synthesis of nanomaterials-Top down and bottom-up approaches, Synthesis by sol-gel method, Nanoscale materials-

Fullerenes, Carbon nanotubes and Graphene, Properties and applications, Biosensors

Spectroscopy: Introduction to spectroscopy, Microwave spectroscopy-Principle, Selection rules, Applications, Infra-red spectroscopy-Principle, Selection rules, Applications, UV Spectroscopy-Lambert-Beer's law and its applications

Self Learning Topics (SLTs): *Introduction to nanotechnology (Text 1: Jain & Jain: chapter 37 topic 1), Electromagnetic spectrum (Text 1: Jain & Jain, chapter 35 topic 1)*

UNIT-IV	**9 Hrs**

Polymers: Introduction, Monomer, Polymer, Types of polymerization reactions-Addition and condensation, Preparation, Properties and Applications-Polythene, Polyvinyl cyanide, Polyvinyl chloride, Bakelite, Nylon 6:6, Thermosetting resins and thermoplastic resins, Conducting polymers and their applications

Green Chemistry: Principles of green chemistry, Synthesis of adipic acid by traditional pathway and green pathway, Green methods in electronic production, Impact of electronic waste on environment and public health

Self Learning Topics (SLTs): *Mechanism of addition polymerization (Text 1: Jain &Jain: chapter 3, topic 6), Alternative solvents for green synthesis ((Text 2: Jain &Jain: chapter 36, topic 5)*

LABORATORY COMPONENT

List of Experiments

1. Estimation of hydroxide ion by acidimetry using standard sodium carbonate solution
2. Estimation of alkalinity of water sample containing (i) carbonate, (ii) carbonate & bi carbonate in ground water
3. Estimation of alkalinity of water sample containing (i) bicarbonate, (ii) carbonate & hydroxide in potable water
4. Determination of hardness of water by complexometric method
5. Determination of dissolved oxygen in a sample of water
6. Standardization of sodium hydroxide (NaOH) by conductometry using standard hydrochloric acid (HCl)
7. Standardization of acetic acid (CH_3COOH) by conductometry using standard sodium hydroxide (NaOH)
8. Standardization of strong acid hydrochloric acid (HCl) by potentiometry using standard sodium hydroxide (NaOH)
9. Colorimetric analysis-verification of Lambert-Beer's law
10. Estimation of ferrous (Fe^{2+}) ion in the given solution using potassium permanganate
11. Preparation of nanoparticles of cadmium sulphide (CdS)
12. Synthesis of polymer (phenol- formaldehyde)

Text Book(s):

1. Jain and Jain, *Engineering Chemistry*, Dhanpat Rai Publishing Company, 17th Edn., 2019 (chapters 1, 3, 5, 6, 7, 35, 36, 37)
2. Dornfeld, D.A., *Green manufacturing: fundamentals and applications,* Springer Science & Business Media, 2012 (chapters 5, 8, 9)

Reference Book(s):

1. J.C. Kuriacose and J. Rajaram, *Chemistry in Engineering and Technology* (vol. I), Tata Mc. Graw-Hills Education Pvt. Ltd., 2010
2. Shashi Chawla, *Text book of Engineering Chemistry*, 3rdEdn., Dhanpat Rai Publishers, 2003
3. S.S. Dara, S.S. Umare, *A Text book of Engineering Chemistry*, 12thEdn., S. Chand & Company Ltd.,2010

Web and Video link(s):

https://elearn.nptel.ac.in/shop/iit-workshops/completed/battery-cell-technology-materials-and-industrial-applications/?v=c86ee0d9d7ed *NPTEL Video Lecture on Battery technology by Dr. Kothandaraman, Professor of Chemistry, IIT Madras & Dr. Raghunathan, Professor of Chemical engineering, IIT Madras*

Laboratory Manual (for laboratory component):

1. *Engineering Chemistry Laboratory manual,* Department of PS, KITSW

Course Articulation Matrix (CAM):		**U24CY102B: ENGINEERING CHEMISTRY**												
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	**U24CY102B.1**	2	-	-	-	1	1	1	-	1	-	1	2	2
CO2	**U24CY102B.2**	2	-	-	-	1	1	1	-	1	-	1	2	2
CO3	**U24CY102B.3**	2	-	-	-	1	1	1	-	1	-	1	2	2
CO4	**U24CY102B.4**	2	-	-	-	1	2	1	-	1	-	1	2	2
CO5	**U24CY102B.5**	2	1	-	-	-	1	1	-	1	-	1	2	2
CO6	**U24CY102B.6**	2	1	-	-	2	1	1	-	1	-	1	2	2
CO7	**U24CY102B.7**	2	1	-	-	-	1	1	-	1	-	1	2	2
CO8	**U24CY102B.8**	2	1	-	-	-	1	1	-	1	-	1	2	2
U24CY102B		**2.00**	**1.00**	**-**	**-**	**1.20**	**1.12**	**1.00**	**-**	**1.00**	**-**	**1.00**	**2**	**2**

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	apply the concepts of electrochemical energy systems for batteries and fuel cells	SDG 7, SDG 9	Affordable and Clean Energy; Industry, Innovation and Infrastructure	Promotes clean energy technologies and advances sustainable engineering solutions
CO2	interpret suitable techniques of water analysis and corrosion treatment of solid materials	SDG 6, SDG 9	Clean Water and Sanitation; Industry, Innovation and Infrastructure	Supports water quality management and improves the durability of engineering infrastructure
CO3	apprise manufacturing of engineering materials and spectroscopic techniques of chemical analysis	SDG 9	Industry, Innovation and Infrastructure	Enhances material development and analytical techniques for industrial innovation
CO4	apprise the synthesis, applications of engineering materials and principles of green chemistry	SDG 12, SDG 13	Responsible Consumption and Production; Climate Action	Encourages sustainable material development and environmentally responsible chemical processes
CO5	determine water quality parameters alkalinity and hardness	SDG 6	Clean Water and Sanitation	Supports assessment and monitoring of water quality for sustainable water management
CO6	make use of analytical instruments for chemical analysis	SDG 9	Industry, Innovation and Infrastructure	Develops practical skills in chemical analysis for research and industrial applications
CO7	determine metals present in their ores	SDG 9	Industry, Innovation and Infrastructure	Strengthens knowledge of material characterization for sustainable resource utilization
CO8	design the synthesis of nanomaterial and polymer	SDG 9, SDG 12	Industry, Innovation and Infrastructure; Responsible Consumption and Production	Promotes innovative material synthesis using sustainable engineering practices

DIGITAL LOGIC DESIGN			
Class: B.Tech. I -Semester		**Branch:** Computer Science & Engineering (IoT)	
Course Code:	**U24CI103**	**Credits:**	**3**
Hours/Week (L-T-P-O-E):	**2-1-0-4-7**	**CIE Marks (%):**	**60**
Total Number of Teaching Hours:	**36 Hrs**	**ESE Marks (%):**	**40**

Course Learning Outcomes (COs):

After completion of this course, the students should be able to,

CO1: apply Karnaugh maps for minimization of switching functions

CO2: design combinational circuits for real world applications

CO3: design sequential circuits for real world applications

CO4: design logic circuits using PLDs

UNIT-I	9 Hrs

Number Systems and Codes: Representation of number systems, conversion of numbers from one radix to other, Binary arithmetic, 1's and 2's complement subtraction, Binary weighted and non-weighted codes – BCD, Self complementing, Gray Codes.

Boolean Algebra and Minimization: Postulates and theorems, logic gates –symbols and truth tables, realization of switching functions - AOI, NAND-NAND and NOR-NOR realizations, minimization of switching functions - using theorems, standard SOP & POS forms, Karnaugh map.

Self Learning Topics (SLTs): *r's and (r-1)'s complements, (Text1: topic 1.5), Excess-3 Code (Text1: topics 1.7), Solved problems on Five Variable K-maps (Text1: topic 3.4)*

UNIT-II	9 Hrs

Combinational circuits: Design of combinational circuits using logic gates – Half adder, Full adder, Half subtractor, Full subtractor, Parallel adder, Carry look ahead adder, BCD adder and 1's & 2's complement adder/subtractors, Decoders, Encoders, Priority encoders, Multiplexers, Demultiplexers, Realization of switching functions using Multiplexers.

Self Learning Topics (SLTs): *Serial adder (Text1: topic 4.3), BCD to Seven Segment Decoder (Text1: topic 5.5), Solved problems on multiplexers (Ref.2: 4.29).*

UNIT-III	9 Hrs

Sequential circuits: NAND RS latch, NOR RS latch, Flip flops- SR, JK, D and T, preset and clear inputs, truth tables, excitation tables , race around condition, Master slave flip flop, conversion of one flip flop to other, Binary counters – ripple and synchronous counters, Shift registers – modes of operation, Ring and Johnson counters.

Self Learning Topics (SLTs): *Mod-n asynchronous counters (Ref.2: topic 6.26), Solved problems on synchronous counters (Ref.2: topic 6.29).*

UNIT-IV	9 Hrs

Programmable logic devices (PLDS): Introduction to PLDs, read only memories (ROMs), programmable logic array devices (PLAs), programmable array logic devices (PALs), implementation of Boolean functions on various PLDs, Introduction to FPGAs and CPLDs.

Self Learning Topics (SLTs): *Combinational circuit implementation (Ref.2: topic 8.4), Solved problems on ROM implementation (Ref.2: Example 8.1, 8.2, 8.3).*

Textbook(s):

1. Moris Mano, *Digital Design*, PHI, 4th edition, New Delhi, 2003 2. Zvi. Kohavi, *Switching and Finite Automata Theory*, Tata McGraw-Hill,New Delhi, 2nd edition, 2008
Reference Book(s): 1. R.P. Jain, *Modern Digital Electronics*, Tata McGraw-Hill, 3rd edition, New Delhi, 2003 2. A. Anand Kumar, *Fundamentals of Digital Circuits*, PHI, 3rd edition, New Delhi, 2014 3. Herbert Taub and Donald Schilling, *Digital Integrated Circuits*, Tata McGraw-HillNew Delhi, 2008
Web and Video link(s): 1. NPTEL :: Electrical Engineering - NOC:Digital Circuits , *NPTEL Video Lecture on Digital Circuits*

Course Articulation Matrix (CAM):		U24CI103:DIGITAL LOGIC DESIGN											
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24CI103.1	2	2	-	1	1	-	-	-	-	-	1	1	1
CO2	U24CI103.2	2	2	2	1	1	-	-	-	-	-	1	1	1
CO3	U24CI103.3	2	2	2	1	1	-	-	-	-	-	1	1	1
CO4	U24CI103.4	2	2	2	1	1	-	-	-	-	-	1	1	1
U24IN103		2	2	1.5	1	1	-	-	-	-	-	1	1	1
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	CO Statement *The student should be able to…*	Relevant SDG	SDG Description	Mapping Justification
CO1	apply Karnaugh maps for minimization of switching functions	SDG 4	Quality Education	Develops logical thinking and digital design skills essential for engineering education
CO2	design combinational circuits for real world applications	SDG 9	Industry, Innovation and Infrastructure	Promotes the design of innovative digital systems that support modern technological infrastructure
CO3	design sequential circuits for real world applications	SDG 9	Industry, Innovation and Infrastructure	Enables the development of reliable digital systems for automation and industrial applications
CO4	design logic circuits using PLDs	SDG 9	Industry, Innovation and Infrastructure	Supports innovation through programmable digital system design for advanced engineering applications

PROGRAMMING FOR PROBLEM SOLVING WITH C			
Class: B.Tech. I -Semester		**Branch:** CSE(Networks)	
Course Code:	**U24IN104**	**Credits:**	**4**
Hours/Week (L-T-P-O-E):	**2-1-2-5-10**	**CIE:**	**60 %**
Total Number of Teaching Hours:	**60 Hrs**	**ESE:**	**40 %**

Course Learning Outcomes (COs):

After completion of this course, the students should be able to,

CO1 enumerate programming development steps, design an algorithm and draw a flow chart for a given application

CO2 apply logical skills for problem solving using control structures and arrays

CO3 develop string operations and modular programming with functions

CO4 analyse and implement structures, unions, pointers and files in C programming

CO5 develop programs using operators and decision making statements

CO6 apply loops and arrays to develop a program of an application

CO7 implement string operations and develop modular programs using user-defined functions, recursion, and storage classes

CO8 develop programs using structures, unions, pointers and files

THEORY COMPONENT

UNIT-I	9 Hrs

Introduction to Programming: Art of programming through algorithms and flowcharts

Overview of C: History of C, Importance of C, Basic structure of C programs

Constants, Variables and Data Types: Character set, C tokens, Declaration of variables, Defining symbolic constants

Managing Input and Output Operations: Reading a character, Writing a character**,** Formatted input, Formatted output

Operators and Expressions: Arithmetic, Relational, Increment, Decrement, Conditional, Logical, Bit-wise, Special operators, Arithmetic expressions, Evaluation of expressions, Operator precedence and associativity

Self Learning Topics (SLTs): *Components of a computer, concept of hardware and software (Text1: chapter 1), Executing a C program (Text1: chapter 2), Type conversions in expression (Text1: chapter 4) Solved problems (Text1: chapter 2 to chapter 5), Review questions, debugging exercises, programming exercises, interview questions (Text1: chapter 2 to chapter 5)*

UNIT-II	9 Hrs

Decision Making and Branching: Simple if statement, if-else statement, Nesting of if-else statements, else if ladder, switch statement, Conditional operator, goto statement

Decision Making and Looping: while statement, do-while statement, for statement, Nested loops, Jumps in loops

Arrays: One-dimensional arrays, Declaration of one-dimensional arrays, Initialization of one-dimensional arrays, Linear search, Two-dimensional arrays, Initializing two dimensional arrays, Multi-dimensional arrays

Self Learning Topics (SLTs): *Concise test expressions (Text1: chapter 7) Dynamic arrays (Text1: chapter 8), Solved problems (Text1: chapter 6 to chapter 8), Review questions, debugging exercises, programming exercises, interview questions (Text1: chapter 6 to chapter 8)*

UNIT-III	9 Hrs

Character Arrays and Strings: Declaring and initializing string variable, Reading strings from terminal, Writing strings to screen, String handling functions, Table of strings

Modular Programming with User Defined Functions: Need for user-defined functions, Elements of user-defined functions, Definition of functions, Return values and their types, Function calls, Function declaration, Category of functions, Recursion, The scope, visibility and lifetime of variables (storage classes)

Self Learning Topics (SLTs): *Arithmetic operations on characters, comparison of strings (Text1: chapter 9), Nesting of functions, (Text1: chapter 10), Solved problems (Text1: chapter 9 & chapter 10), Review questions, debugging exercises, programming exercises, interview questions (Text1: chapter 9 & chapter 10).*

UNIT-IV	9 Hrs

Structures and Unions: Defining a structure, Declaring and initializing structure variables, Accessing structure members, Array of structures, Structures within structures, Unions

Pointers: Understanding pointers, Declaring and initializing pointer variables, Pointer expressions, Pointers and arrays, Pointers and character strings, Pointers to functions, Pointers and structures

File Management in C: Defining and opening a file, Closing a file, Input and output operations on sequential text files

Self Learning Topics (SLTs):*Operations on individual members (Text1: chapter 11), Chain of pointers, array of pointers (Text1: chapter 12), Random access to files, Command line arguments (Text1: chapter 13). Solved problems (Text1: chapter 11 to chapter 13), Review questions, debugging exercises, programming exercises, interview questions (Text1: chapter 11 to chapter 13).*

LABORATORY COMPONENT

List of Experiments

1. Programs using input-output functions, operators (arithmetic, relational and conditional)
2. Programs using operators (bit-wise, logical, increment and decrement)
3. Programs using conditional control structures: if, if-else, nested if
4. Programs using else if ladder, switch and goto statements
5. Programs using loop control structures: while
6. Programs using loop control structures: do-while and for
7. Programs on one dimensional array and two-dimensional arrays
8. Programs on String operations and string handling functions
9. Programs on different types of functions, parameter passing using call-by-value & call-by-address, recursion and storage classes
10. Programs using structures, unions, pointers to arrays and pointers to strings
11. Programs using array of pointers and pointers to structures
12. Programs on File operations and file handling functions for sequential text files

Textbook(s):

1. Balagurusamy.E, *Programming in ANSI C*, McGraw Hill, 8th edition, 2022

Reference Book(s):

1. Paul Deitel, Harvey Deitel, *C How to Program: With Case Studies Introducing Applications Programming and Systems Programming*, Pearson Education Limited, 9th edition, 2022
2. Brian W. Kernighan and Dennis Ritchie, *The C Programming Language*, Pearson Education

India, 2nd edition, 2015
3. Reema Thareja, *Programming in C,* Oxford University Press, 3rd edition, 2023
4. Yashavant Kanetkar, *Let Us C,* BPB Publications, 19th edition, 2022
5. A.K.Sharma, *Computer Fundamentals and Programming in C,*Universities Press, 2nd edition, 2018

Web and Video link(s):

https://nptel.ac.in/courses/106105171*NPTEL Video Lecture on Problem Solving through Programming in C by Prof. Anupam Basu, Professor of CSE, IIT Kharagpur.*

https://nptel.ac.in/courses/106104128*NPTEL Video Lecture on Introduction to Programming in C by Prof. Satyadev Nandakumar, Professor of CSE, IIT Kanpur*

Laboratory Manual (for laboratory component):
Programming for Problem Solving with C Laboratory Manual and Record Book, Department of CSE, KITSW.

Course Articulation Matrix (CAM):		**U24IN104: PROGRAMMING FOR PROBLEM SOLVING WITH C**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24IN104.1**	2	1	1	1	-	-	-	1	-	1	2	1	2
CO2	**U24IN104.2**	2	2	2	1	-	-	-	1	-	1	2	2	2
CO3	**U24IN104.3**	2	2	3	1	-	-	-	1	-	1	2	2	2
CO4	**U24IN104.4**	2	2	3	2	-	-	-	1	-	1	2	2	2
CO5	**U24IN104.5**	1	1	1	1	1	-	-	1	1	1	2	1	2
CO6	**U24IN104.6**	1	2	2	2	1	-	-	1	1	1	2	2	2
CO7	**U24IN104.7**	1	2	3	2	1	-	-	1	1	1	2	2	2
CO8	**U24IN104.8**	1	2	3	2	1	-	-	1	1	1	2	2	2
U24IN104		**1.5**	**1.75**	**2.25**	**1.5**	**1**	**-**	**-**	**1**	**1**	**1**	**2**	**1.75**	**2**

CO–SDG Alignment Matrix				
CO	**CO Statement (The student should be able to…)**	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	enumerate programming development steps, design an algorithm and draw a flowchart for a given application	SDG 4	Quality Education	Builds computational thinking, algorithmic design, and logical reasoning skills essential for quality technical education
CO2	apply logical skills for problem solving using control structures and arrays	SDG 4	Quality Education	Enhances programming and analytical skills required to solve computational problems effectively
CO3	develop string operations and modular programming with functions	SDG 9	Industry, Innovation and Infrastructure	Promotes software development practices through modular programming, supporting innovation and efficient software engineering
CO4	analyze and implement structures, unions, pointers and files in c programming	SDG 9	Industry, Innovation and Infrastructure	Develops advanced programming skills for efficient data management and software applications used in industrial systems
CO5	develop programs using operators and decision-making statements	SDG 4	Quality Education	Strengthens practical programming competencies through laboratory-based implementation of fundamental programming concepts
CO6	apply loops and arrays to develop programs for applications	SDG 4	Quality Education	Reinforces programming proficiency and logical problem-solving through hands-on coding exercises
CO7	implement string operations and develop modular programs using user-defined functions, recursion, and storage classes	SDG 9	Industry, Innovation and Infrastructure	Encourages structured software development techniques applicable to modern computing and industrial applications
CO8	develop programs using structures, unions, pointers and files	SDG 9	Industry, Innovation and Infrastructure	Enables the development of efficient and scalable software solutions for engineering and industrial computing applications

ENGLISH COMMUNICATION AND REPORT WRITING

Class:B.Tech. I-Semester		**Branch:** Common to all branches	
CourseCode:	**U24MH105**	**Credits:**	**2**
Hours/Week(L-T-P-O-E):	**2-0-0-3-5**	**CIE:**	**60 %**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40 %**

CourseLearningOutcomes(COs):

After completion of this course ,the students should be able to,

CO1: apply basic grammar principles in speech and writing, readfast ,form new words, make coherent paragraphs and adapt the real value of life.

CO2: create effective letters, e-mails , reply to Memos and do the given tasks with confidence.

CO3: analyzethe given texts and write clear and unambiguous reports.

CO4: deduct the superfluous information from lengthy text, prepare SoP(Statement of Purpose) effectively andsolve critical problems in life with emotional balance

UNIT-I	**9Hrs**

GRAMMAR

- Tenses-Structures-usage-examples-exercises for practice
- Sentence Correction-Correct use of Tenses, Verb forms, Punctuation.

VOCABULARY

- Word formation:Prefixes-Suffixes-Sentence Formation with newly formed words

READING SKILL

- Definition-Sub skills of Reading-Emphasis on Skimming-Purpose-How to skim through the text-Examples, Exercises for practice

WRITING PRACTICES

- ParagraphWriting-Definition-Organizing Principles of paragraphs-Making a paragraph through hints/graphs and pictures-Coherence-Linking Devices-Systematic Development of Ideas
- Paraphrasing-Précising lengthy expressions for clarityand brevity

LIFE SKILLS: Ethical Values and Humanity, TheLastLeaf:AShortStorybyO.Henry

SelfLearningTopics(SLTs):

Articles-(Text2,Unit-II),EnglishVocabulary(Text2,Unit-I,Unit-II,Unit-III)

Verb Forms (Reference book1,Topic:31),Tenses(Referencebook1,Topics:16,17,18,19)

Reported Speech (Reference book 2, Exercises for Practice, Topics : 161-167)

UNIT-II	**9 Hrs`**

GRAMMAR

- Tenses-Revision-Exercisesforpractice
- Subject-VerbAgreement
- ReportedSpeech-Transformation
- SentenceCorrection-EmphasisConcord ,Report Speech, Sentence Structures

VOCABULARY

- Synonyms-Antonyms-SingleWordSubstitutes-PopularAbbreviations

READING STRATEGY

- Emphasison Scanning the Text-Purpose - Advantages-Examples, Exercises and Practice

through Teamwork

WRITING PRACTICES

- Letter Writing- Effective Letter Writing Techniques – Information Seeking Letters-Job Application Letters- Apology Letters-Explanation to Memos- E-mails-Cover Letters-Resume

LIFE SKILLS: Determination

- How I Became a Public Speaker: An essay by George Bernard Shaw

Self Learning Topics (SLTs): *English Vocabulary (Text2, Unit-I, Unit-II, Unit III), Tensesz Reference book 3,Topic-30, Exercises,3.0.1,3.0.2,3.0.3)*

UNIT-III	**9 Hrs**

GRAMMAR

- Tenses-Revision-ExercisesforPractice
- Nouns-Prepositions-Adverbs-Adjectives
- Sentence Correction: Correct Useoftenses,nouns,prepositions,adverbsandadjectives

VOCABULARY

- Phrasal Verbs –Technical Words- Latin Words

READINGSTRATEGY

- Intensive Reading- purpose- Types of Comprehension Questions-Examples, Exercises and Practice through Teamwork

WRITINGPRACTICES

- ReportWriting-Definition-Purpose-QualitiesofaGoodReport-Formal and Informal Reports-Report Format-Sample Reports-Exercises
- EmphasisonTechnical Reports

LIFE SKILLS: PositiveAttitude

- Be the Best o fWhatever You Are: A Poem by Douglas Malloch

SelfLearningTopics(SLTs): *Parts of Speech (Textbook1,Unit-I), Tenses (Referencebook1, Topics - 16,17,18,19) Phrasal Verbs (Reference book 3)*

UNIT-IV	**9 Hrs**

GRAMMAR

- Tenses- Revision-ExercisesforPractice
- Clauses-Conjunctions-TransformationofSentences
- SentenceCorrection(BasedonPartsofSpeech)-Clauses-Tenses

VOCABULARY

- AppropriateUseofWordsinCommunication-CommonlyConfusedWords

ACTIVEREADINGandNOTE-MAKING

- Note-Making-Definition-Purpose-Effectiveness

WRITINGPRACTICES

- Précis Writing- Definition-Purpose-Uses- Examples and Exercises –Practice throughTeamwork
- Preparing Statement of Purpose (SoP)

LIFESKILLS: Emotional Balance A Poison Tree: Poem by William Blake

Self-Learning Topics(SLTs): Tenses (Reference book 2, Topics:152-157))

Textbook(s):

1. Sanjay Kumar &Pushp Lata,*"English Language and Communication Skills for Engineers"* As per the latest AICTE syllabus,Oxford University Press, 1st edition 2018

2. *"Language and Life: A Skill'sApproach"* Based on the latest AICTE model curriculum Orient Black swan Private Limited 2nd Edition 2019.

ReferenceBook(s):

1. Thomson A.J. ,Martinet A.V.,"*APracticalEnglishGrammar*",OxfordUniversityPress 3rdEdition1997
2. Thomson A.J. ,.Martinet A.V,"*APracticalEnglishGrammar*"Exercise2,OxfordUniversity Press 3rdEdition1997
3. StandardAllen W. ,"*LivingEnglishStructure*",PearsonIndiaEducationPvtLtd. 5thEdition2009

WebandVideolink(s):

1. https://onlinecourses.nptel.ac.in/noc20_hs56/preview Technical English for Engineers by Aisha Icbal, IIT Madars
2. https://onlinecourses.swayam2.ac.in/cec21_lg13/preview Indian Writing in English by Dr.Bindu Ann Philip, St.Mary's College Trissur

Course Articulation Matrix (CAM):		**U24MH105: ENGLISH COMMUNICATION & REPORT WRITING**												
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	**U24MH105.1**	-	-	-	-	-	1	-	2	2	2	2	1	1
CO2	**U24MH105.2**	-	-	-	-	-	1	-	2	2	2	2	1	1
CO3	**U24MH105.3**	-	-	-	-	-	1	-	2	2	2	2	1	1
CO4	**U24MH105.4**	-	-	-	-	-	1	-	2	2	2	2	1	1
U24MH105		**-**	**-**	**-**	**-**	**-**	**1**		**2**	**2**	**2**	**2**	**1**	**1**
3 – HIGH, 2 – MEDIUM, 1 – LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	apply basic grammar principles in speech and writing, read fast, form new words, make coherent paragraphs, and appreciate the real value of life	**SDG 4**	Quality Education	Developing language proficiency, reading, writing, and communication skills promotes quality education and lifelong learning
CO2	create effective letters, e-mails, reply to memos, and perform communication tasks with confidence	**SDG 8**	Decent Work and Economic Growth	Professional written communication skills improve workplace readiness, employability, and career development
CO3	analyze the given texts and write clear and unambiguous reports	**SDG 4**	Quality Education	Analytical reading and report-writing skills enhance critical thinking, academic excellence, and effective communication
CO4	deduct the superfluous information from lengthy texts, prepare statements of purpose (sop) effectively, and solve critical problems in life with emotional balance	**SDG 3**	Good Health and Well-being	Critical thinking, emotional resilience, and effective self-expression contribute to personal well-being, decision-making, and holistic development

SPORTS AND YOGA

Class: B.Tech. I-Semester		**Branch: Common to all branches**	
Course Code:	**U24VA106**	**Credits:**	**1**
Hours/Week(L-T-P-O-E):	**0-0-2-2-4**	**CIE:**	**60(%)**
Total Number of Teaching Hours:	**24Hrs**	**ESE:**	**40(%)**

CourseLearningOutcomes (COs):

After completion of this course, the student should be able to demonstrate …

CO1: demonstrate physical fitness by performing yoga aasanas

CO2: demonstrate physical fitness through various games & sports events with defined benchmarks

CO3: demonstrate sportsman spirit and ethics

CO4: demonstrate physical, psychological, social and emotional balance

Sports and Games

List of Sports and Games			
Sl.No.	**Game**	**Sl.No**	**Game**
1	Badminton	7	Volleyball
2	Basketball	8	Cricket
3	Chess	9	Hand Ball
4	Carrom	10	Kabaddi
5	Foot Ball	11	Kho-Kho
6	Table Tennis	12	Yoga Aasanas

Textbook(s):

1. B.K.Chaturvedi,*Rules and Skills of Games and Sports,* Publisher – Goodwill Publishing House, B-9, Rattan Jyoti, 18 Rajendra Place, New Delhi.

ReferenceBook(s):

1. Dr.Sakure Girish Madhaorao, *Foundation of Physical Education and Sports*, Sports Publication,New Delhi.

Web and Video link(s):

1. Badminton game Video Link: https://www.youtube.com/watch?v=HucIqi8Lw3E&t=22s
2. Basketballgame Video Link: https://www.youtube.com/watch?v=-tkE2lJoR58
3. Chess Video Link: https://www.youtube.com/watch?v=mDw7lgM8ePo
4. Carrom game Video Link: https://www.youtube.com/watch?v=z8vvJpNceeg
5. Football game Video Link: https://www.youtube.com/watch?v=mXjW78AgGu4
6. Table Tennis game Video Link: https://www.youtube.com/watch?v=bLrJGWvWI4U
7. Volleyball game Video Link: https://www.youtube.com/watch?v=BJJb3-O0Q1U
8. Cricket game Video Link: https://www.youtube.com/watch?v=87hO_Vs3-wQ
9. Handball game Video Link:https://www.youtube.com/watch?v=VCa_0USaq8k
10. Kabaddi game Video Link: https://www.youtube.com/watch?v=ai1m7ARNyNI
11. Kho-Kho game Video Link: https://www.youtube.com/watch?v=P3_z3LKdLdg
12. Yoga Aasanas Video Link : https://www.youtube.com/watch?v=e0Q88DUOXjk
13. https://www.youtube.com/watch?v=JoDKbXEUrvQ

Course Articulation Matrix (CAM):		U24VA106 Sports and Yoga											
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24VA106.1	-	-	-	-	-	-	-	-	-	-	1	1	1
CO2	U24VA106.2	-	-	-	-	-	-	-	-	1	-	-	1	1
CO3	U24VA106.3	-	-	-	-	-	-	-	2	-	-	-	1	1
CO4	U24VA106.4	-	-	-	-	-	-	-	-	-	1	1	1	1
U24VA106		-	-	-	-	-	-	-	2	1	1	1	1	1
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	CO Statement *The student should be able to…*	Relevant SDG	SDG Description	Mapping Justification
CO1	demonstrate physical fitness by performing yoga aasanas	SDG 3	Good Health and Well-being	Practicing yoga enhances physical fitness, mental wellness, flexibility, and promotes a healthy lifestyle
CO2	demonstrate physical fitness through various games and sports events with defined benchmarks	SDG 3	Good Health and Well-being	Participation in sports and physical activities improves fitness, endurance, and overall health and well-being
CO3	demonstrate sportsman spirit and ethics	SDG 16	Peace, Justice and Strong Institutions	Sportsmanship, fairness, discipline, and ethical behavior foster respect, inclusion, and responsible citizenship
CO4	demonstrate physical, psychological, social, and emotional balance	SDG 3	Good Health and Well-being	Developing physical, mental, social, and emotional well-being supports a healthy and balanced lifestyle

ENGINEERING GRAPHICS THROUGH CAD			
Class: B. Tech. I –Semester		**Branch:** Common to all (except CE & ME)	
Course Code:	**U24ME107**	**Credits:**	**1**
Hours/Week (L-T-P-O-E):	**0-0-2-2-4**	**CIE :**	**100 %**
Total Number of Teaching Hours:	**36 Hrs**	**ESE :**	**-**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1: draw projections of points and straight lines inclined to one plane with Auto CAD.
CO2: develop the projections of planes using Auto CAD
CO3: construct the projections of solids and sections of solids using Auto CAD
CO4: create orthographic and isometric projections and develop the simple electrical and electronic circuit using Auto CAD

LABORATORY COMPONENT

List of Experiments

1. Importance of Engineering Drawing, principles of engineering drawing, dimensioning, introduction to AutoCAD software-GUI, settings, standard toolbar, toolbars - draw, modify, dimension, properties, design centre and tool palettes
2. Introduction to orthographic projections-Vertical Plane, Horizontal plane, Views-Front view, Top view, and Side view and draw the Projection of points in different quadrants.
3. Draw the Projection of straight lines
4. Draw the Projection of planes
5. Draw the Projection of solids- Simple position(Axis perpendicular to HP or VP)
6. Draw the projections of solids inclined to both the planes
7. Draw the Sections of solids
8. Draw the Orthographic projections of given objects
9. Conversion of isometric view to orthographic projections
10. Draw the Isometric view from the given orthographic views
11. Draw the pictorial view (3D) from the given Isometric view
12. AutoCAD application in Electrical and Electronics circuits

Textbook(s):

1. Bhatt N.D., *Elementary Engineering Drawing*, Charotar Publishing House, Anand, India, 2017.
2. Kulkarni D. M., Rastogi A. P., and Sarkar A., *Engineering Graphics with AutoCAD*, PHI publisher, revised edition, July 2010.

Reference Book(s):

1. Dhananjay A Jolhe, *Engineering Drawing*, Tata Mc Graw- Hill, 2008.
2. Venugopal K. *Engineering Graphics with Auto CAD*, New Age International Publishers Ltd., Hyderabad, 2012.
3. Luzadder W.J and Duff J.M, *Fundamentals of Engineering Drawing*, Prentice-Hall of India, 1995.

Web and Video link(s):

https://onlinecourses.nptel.ac.in/noc20_me79/preview *NPTEL video link for* ***Engineering drawing and computer graphics*** *By Prof. Rajaram Lakkaraju, IIT Kharagpur.*

Laboratory Manual (for laboratory component):

1. *Engineering Graphics through CAD Laboratory Manual & Record Book,* Dept. of ME, KITSW.

Course Articulation Matrix (CAM): U24ME107 ENGINEERING GRAPHICS THROUGH CAD														
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24ME107.1	2	1	1	-	2	-	-	1	-	2	1	1	1
CO2	U24ME107.2	2	1	1	-	2	-	-	1	-	2	1	1	1
CO3	U24ME107.3	2	1	1	-	2	-	-	1	-	2	1	1	1
CO4	U24ME107.4	2	1	1	-	2	-	-	1	-	2	1	1	1
U24ME107		**2**	**1**	**1**	**-**	**2**	**-**	**-**	**1**		**2**	**1**	**1**	**1**

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	draw projections of points and straight lines inclined to one plane using autocad	**SDG 4**	Quality Education	Learning engineering graphics and AutoCAD develops technical drawing skills and enhances industry-oriented engineering education
CO2	develop the projections of planes using autocad	**SDG 4**	Quality Education	Applying AutoCAD for plane projections strengthens spatial visualization and practical design skills essential for engineering practice
CO3	construct the projections of solids and sections of solids using autocad	**SDG 9**	Industry, Innovation and Infrastructure	Creating accurate engineering models using CAD tools supports innovative product design and modern engineering infrastructure
CO4	create orthographic and isometric projections and develop simple electrical and electronic circuits using autocad	**SDG 9**	Industry, Innovation and Infrastructure	Using AutoCAD for engineering drawings and circuit design promotes digital design practices, innovation, and technology-driven infrastructure development

PRACTICUM-1			
Class: B.Tech. I Semester	**Branch:** Common to all branches		
Course Code:	**U24EL108**	**Credits:**	**1**
Hours/Week (L-T-P-O-E):	**0-0-0-4-4**	**CIE Marks :**	**100%**
Total Number of Teaching Hours:	**-**	**ESE Marks :**	**-**

Course Learning Outcomes (COs):

After completion of this course, the students should be able to…

CO1: synthesize literature survey, identify research gaps and define objective & scope of practicum problem

CO2: apply knowledge to design & conduct experiments, utilize modern tools for solution of practicum problem and develop working model/ process/ system

CO3: demonstrate the generic competencies in making a well-documented report portraying knowledge, skills, qualities acquired through practicum

CO4: create a video pitch on practicum and make an effective oral presentation using PPTs

Practicum is an independent project carried out by the student during the course period, under the supervision of allotted course faculty. It helps to reinforce the students' theoretical knowledge and develop their ability to apply this knowledge to the solution of practical problems. Practicums also prepare them for their MINI and MAJOR PROJECTs and for independent work in their chosen field that promotes creative abilities. Besides they provide Higher Order Cognitive Abilities (HOCAs).

(i). Practicum is a mandatory semester project work.

(ii). Practicum is offered as a one credit course. Student has to earn 4 credits (one in each semester from I to IV semesters)

(iii). Allotment of Practicum topics for students:

- **Practicum matrix:** In week (-1), the class teacher, in consultation with HoD, shall prepare the practicum matrix of the section. The practicum matrix is the allotment of group of students to the different course faculty of the section, as shown below.

Course	U24MH101	U24CY102	U24CI103	U24IN104	U24MH105	U24CH106
Student	B24XX001	B24XX011	B24XX021	B24XX031	B24XX041	B24XX051

s allotted to different courses	B24XX002	B24XX012	B24XX022	B24XX032	B24XX042	B24XX052
	B24XX003	B24XX013	B24XX023	B24XX033	B24XX043	B24XX053
	B24XX004	B24XX014	B24XX024	B24XX034	B24XX044	B24XX054
	B24XX005	B24XX015	B24XX025	B24XX035	B24XX045	B24XX055
	B24XX006	B24XX016	B24XX026	B24XX036	B24XX046	B24XX056
	B24XX007	B24XX017	B24XX027	B24XX037	B24XX047	B24XX057
	B24XX008	B24XX018	B24XX028	B24XX038	B24XX048	B24XX058
	B24XX009	B24XX019	B24XX029	B24XX039	B24XX049	B24XX059
	B24XX010	B24XX020	B24XX030	B24XX040	B24XX050	B24XX060

- In week (-1), the class teacher of a section shall collect 10-12 topics for practicum from each of the course teachers of that section.
- The class teacher, in consultation with HoD shall allot the practicum topics to the students of that section in the following format.

****

CIRCULAR

Allotment of Practicum topics to students

Section : …….

S.No.	oll number of the student	Practicum topic allotted	acticum under the course	Course faculty

Note:

1. The students should meet immediately the allotted course faculty for practicum and start working on the practicum with the guidance of course faculty.
2. To complete the Practicum, the student shall work in laboratories under supervision of allotted course faculty, in the allotted hours in the classwork timetable and also outside the class work hours during weekdays.

3. The course faculty are advised to guide the allotted students for practicum during the semester course work.

(Signature of class teacher)

****

(iv). ***To complete the practicum, the student shall work in laboratories under supervision of allotted course faculty, in the allotted hours in the classwork timetable and outside the class work hours during weekdays.***

(v). There shall be only continuous Internal Evaluation (CIE) for practicum for a maximum of 100 marks.

(vi). The practicum course faculty shall evaluate & submit the final marks of the allotted students in week (N+1) to the respective class teacher.

(vii). The class teacher shall collect the final marks of practicum of the students allotted to each course teacher and submit them to the CoE.

viii). Course faculty shall follow his/her own rubrics for practicum evaluation. Focus shall be on knowledge, skills & qualities acquired by the student during the practicum course

(ix). A sample rubrics for assessment and evaluation of practicum is as follows:

Literature survey & Identification of research gaps	10 marks
Working model / process / software package / system developed	30 marks
Report writing (subjected to max of 30% plagiarism)	20 marks
Oral presentation with PPT and viva-voce	20 marks
Video pitch	20 marks
Total	100 marks

Note: It is mandatory for the student to appear for oral presentation and viva-voce to qualify for course evaluation of Practicum.

(a) **Practicum Topic**: Each student shall be allotted a topic for practicum by the course faculty member attached to him/her. Interested students can work on their own title for practicum, but with due approval from course faculty.

(b) **Working Model**: Each student is required to develop a prototype / process / system/simulation model on the given practicum topic and

demonstrate/present, during the allotted time, before the course teacher.

(c) **Report:** Each student is required to submit a well-documented report on the allotted practicum topic as per the format specified by the course faculty. The student shall include answers to the following questions in the report and ppt presentation.

- What was the objective of the practicum assigned?
- What are the main responsibilities and tasks for practicum?
- What knowledge and skills from the coursework are applied in the practicum?
- What new knowledge and skills are acquired during the practicum?
- In what ways, can the practicum be helpful for the professional career?
- What gaps are identified in your practicum work?
- What improvements or changes you suggest for addressing the identified gaps for future work?

(d) **Anti-Plagiarism Check:** The practicum report should clear plagiarism check as per the Anti-Plagiarism policy of the institute

(e) **Presentation:** Each student should prepare PPT with informative slides and make an effective oral presentation before the course teacheras per the schedule notified by the department

(f) **Video Pitch:** Each student should create a pitch video, which is a video presentation on his / her Practicum. Video pitch should be no longer than 5 minutes by keeping the pitch concise and to the point, which shall also include evidence like videos & pics at the time of implementing the practicum and also key points about his / her business idea / plan (*if any*) and social impact

(g) The student has to register for the Practicum as a supplementary examination in the following cases:

i)he/she is absent for oral presentation and viva-voce

ii) he/she fails to submit the report in prescribed format

iii) he/she fails to fulfill the requirements of Practicum evaluation as per specified guidelines

Course Articulation Matrix (CAM):		U24VA108: PRACTICUM-1												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24VA108.1	2	3	2	3	2	–	–	–	1	1	2	2	2
CO2	U24VA108.2	3	3	3	3	3	–	–	–	2	1	2	3	3
CO3	U24VA108.3	2	2	1	2	2	–	–	1	2	3	2	2	2
CO4	U24VA108.4	1	1	1	1	2	–	–	1	2	3	2	1	1
U24VA108		2	2.00	2.25	1.75	2.25	2.25	–	–	0.50	1.75	2.00	2.00	2.00
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	CO Statement (The student should be able to…)	Relevant SDG	SDG Description	Mapping Justification
CO1	synthesize literature survey, identify research gaps, and define the objective and scope of the practicum problem.	SDG 4	Quality Education	Develops research aptitude, critical thinking, literature review skills, and the ability to identify and formulate engineering problems.
CO2	apply knowledge to design and conduct experiments, utilize modern tools for solving the practicum problem, and develop a working model/process/system.	SDG 9	Industry, Innovation and Infrastructure	Promotes innovation, engineering design, experimentation, and the application of modern technologies to develop practical and sustainable solutions.
CO3	demonstrate generic competencies in preparing a well-documented report portraying the knowledge, skills, and qualities acquired through the practicum.	SDG 4	Quality Education	Enhances technical writing, documentation, analytical thinking, and reflective learning essential for professional engineering practice.
CO4	create a video pitch on the practicum and make an effective oral presentation using ppts.	SDG 4	Quality Education	Strengthens communication, presentation, digital literacy, and professional dissemination skills for effectively showcasing engineering outcomes.

SOCIAL EMPOWERMENT ACTIVITY / SELF ACCOMPLISHMENT ACTIVITY (SEA-I /SAA-I)			
Class: B.Tech. I Semester		**Branch:** Common to all branches	
Course Code:	**U24VA109XX**	**Credits:**	**1**
Hours/Week (L-T-P-O-E):	**0-0-0-2-2**	**CIE:**	**100%**
Total Number of Teaching Hours:	**-**	**ESE :**	**-**

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

LO1: holistic development through activity-based learning to gain real-life experiencewhicheffectively help individuals deal appropriately with problems/challenges

LO2: positive mindset by actively adopting optimism, acceptance, resilience, gratitude, mindfulness, and integrity and handling rejection in life

LO3:skills for effective fieldwork practice, which include ethics, observation, communication, interviewing, problem solving, time management, organisation and documentation

LO4:making a well-documented report and an effective oral presentation through PPTs portraying knowledge, skills, qualities acquired and social impact of the activity

Activity Based Liberal Learning about Life, Literature and Culture (ABLL@LLC) is introduced for building **generic competencies** in students. ABLL is aimed at all dimensional holistic growth of the learner. The holistic development includes the **physical, emotional, cognitive, spiritual and social aspects**. This is an area which opens the decision-making process, helps the student to develop creativity, an analytical mind, and builds resilience, confidence, hope, well-being and success. This will help student face the world with a greater degree of maturity, stoic and become a wholesome person in the society.

It is more than just learning from books to lead a successful life. These activity-based liberal learning courses, which help students to expand their social roles later in life,

are offered under two sequels namely **SEA** (Social Empowerment Activities) and **SAA** (Self Accomplishment Activities)

These SEA/SAA courses also focus on building positive mindset: adopting optimism, acceptance, resilience, gratitude, mindfulness, and integrity in your life will help student develop and maintain a positive mindset.

(a) Each SEA/SAA activity is treated as one credit course

(b) Student must select one activity per semester, through first 04 semesters, from the courses listed under SEA/ SAA, before commencement of the semester.

(c) Students are required to earn minimum 04 credits under SEA/SAA, by completing minimum 02 credits through SEA and minimum 02 credits through SAA

(d) To complete these activities student shall work outside the class work hours, during weekends, holidays, semester breaks, etc.,

(e) If a student is not able to attend/ fulfil performance requirements, he/she shall be dropped from the course and shall have to enrol in the forthcoming semesters.

Monitoring SEA/SAA:

(a) **Nodal units:** The Student Activity Centre (SAC) and Centre for Innovation Incubation Research and Entrepreneurship (C-i²RE) shall act as nodal units for activities listed under SEA/SAA.

(b) During the semester period, the student has to **acquire requisite knowledge**, **conduct fieldwork**, acquire skills and propose unique solutions to the real-life problems

(c) **Knowledge Acquisition & Skilling**:

i. Students have to identify goals, acquire and accumulate knowledge on the chosen SEA/SAA activity

ii. For the activities related to social awareness/issues/challenges that affect society, use the knowledge base, apply relevant skills to analyse the issue

and propose unique possible solutions to the social issues/challenges. Practice to acquire necessary skills to seek new opportunities in their personal and professional life.

iii. For the activities related to physical fitness, music, dance, fine arts, etc., guided practice sessions under supervision of expert/guru are to be planned and executed to acquire the benchmark skills to be demonstrated.

(d) **Fieldwork:** Fieldwork is an essential component of learning for gaining real-life experiences. In addition to knowledge acquisition & skilling, student has to take up fieldwork on the chosen activity, as part of SEA/SAA course.

i. This student-driven Fieldwork allow students to interact with the 'real world'. It is an autonomous learning (self-learning) situation that students are more actively involved during the activity and develop a deeper understanding and develop a more positive attitude.

ii. Fieldwork consists of three phases: preparation, the actual activity and feedback

iii. As part of fieldwork, student has to interact with at least two eminent personalities/achievers/renowned persons/inspiring and great personalities related to the activity chosen.

iv. Fieldwork will benefit students for any careers where they need to work with communities of people or which involves analysis of complex processes, especially social and cultural.

v. Certain skills are required for effective fieldwork, which include observation, communication, interviewing, problem solving, documentation, and more

vi. Other skills important for fieldwork practice include the ability to act in a crisis, to plan, set priorities, mobilize resources, and implement the plan effectively. These skills used in an integrated manner help students solve their problems and to develop one's own leadership style based on the need and culture of the place.

vii. **Eminent personalities/achievers/renowned persons/inspiring and great personalities**

Eminent personalities/ Achievers / Renowned personalities:

(a). **In case of socially relevant problems/ activities of SEA/SAA:** **E**minent personalities/ achievers include district administrative officers, Eminent Social workers / NGOs, other inspiring and great personalities

(b). **In case of Sports / Games and Cultural activities of SEA/SAA:** Eminent coaches/ trainers/gurus, achievers who represented/won state level/national level /international level competitions, other inspiring and great personalities.

viii. **For appointment to interact eminent personalities**: Student is expected to follow email etiquette rules and other appropriate polite communication etiquettes for getting appointment and time for interaction

ix. On fieldwork, student is expected to demonstrate solid time management, organisational and note taking skills during fieldwork

x. **Ethics of fieldwork**: Fieldwork is an educational process with commitment to positive values. All fieldwork should be planned and conducted in a way that is ethical, responsible and safe, for people, students, visited communities, if any, and all other stakeholders. Student is expected to maintain integrity and honesty. Avoid bias and deception. Protect the rights and well-being of people involved in fieldwork. The privacy, confidentiality and respect for the eminent people interacted should be maintained and their time, inputs & guidance are to be acknowledged

xi. Student is expected to take care of health and Safety practices for fieldwork and travel

xii. Student should remember that contrary to a *field trip or company visit*, **the emphasis in fieldwork is on acquiring skills**, and not on casually presenting theory and assessing.

xiii. For the fieldwork, student shall go with a scientifically designed

questionnaire and record the responses during interaction. These response sheets, along with geo-tagged pic of fieldwork (at the time of interaction & practise sessions, if any) shall be appended as annexures in the report to be submitted for course evaluation.

xiv. **Feedback:** The learnings the student made out of interaction with eminent achievers shall be presented in the report as one of the chapters.

- During feedback, the central focus is on the elaboration of the students' experience during fieldwork. Therefore, the student should create an end product, such as a demonstration/presentation and report in which they demonstrate a link between their experiences during fieldwork and the underlying theoretical concepts and ideas.

(e) **Demonstration / Presentation and Report**: Student after presentation/demonstration of his/her achievements/work, shall get a certificate from the concerned nodal unit and submit a report, in the prescribed format, to the faculty counsellor for award of grade.

(f) **Flow process for completion of SEA/SAA course**:

i. ***Faculty counsellor approval***: In week (-1), in consultation with faculty counsellor, every student shall, identifies minimum of 4 activities listed under SEA/SAA activities, lists their priority and fills the same in ONLINE REGISTRATION FORM FOR SEA/SAA (received in their domain mail id) to Dean, Student Affairs. Dean, Student Affairs shall release the section wise allotment of SEA/SAA courses to students along with the details of supervising faculty of nodal centre. The allotment details shall be shared to the SEA/SAA coordinator and the student through domain mail id of the student

ii. ***Identification of goals and preparation of action plan:*** In week (1), the respective faculty coordinator(s) of nodal centres shall address the students allotted to them to educate them on fixing goals, plan of action for completion and evaluation. In consultation with nodal centre, based

on the workflow of the allotted activity, every student shall identify the goals (of activity) & eminent personalities (to be visited during the field trip) and prepare action plan (oriented workflow) for attaining the identified goals.

iii. ***Field work:*** Under the guidance of nodal centre, student shall complete the field work, based on the action plan, with the progress continuously monitored by the faculty counsellor and the nodal centre.

iv. ***Demonstration/ Presentation:*** After completion of field work, student shall demonstrate/present his achievements (knowledge/skills gained during the activity) at the nodal centre in the presence of external experts/senior practitioners of the activity. After successful demonstration/presentation, the nodal centre shall provide a certificate of completion indicating that the student has completed the activity in the stipulated time.

v. ***Report writing:*** After successful demonstration/presentation, student shall write a 2–3-page report and submit the same to the faculty counsellor. The report shall emphasize knowledge, skills and qualities acquired through the SEA/SAA activities. It shall also include the influence of these activities on enhancing confidence, positive change in life, decision making, transforming choices into desired actions/outcomes.

(g) ***Assessment & Evaluation:*** There shall be *only Continuous Internal Evaluation (CIE) for SEA/SAA.* The SEA/SAA activities shall be evaluated at the end of the semester through respective evaluation processes, which shall include field work, presentation/ demonstration, submission of reports on the gathered data/information/ surveys, the details of which have been shown in below table. The department level SEA/SAA coordinator shall collect marks from the nodal centres and faculty counsellors, consolidate them, and submit the final grades to the examination branch, within one week of the last day of instruction. Evaluation of SEA/SAA activities shall be completed as and when

students are ready, but not later than week (N+1).

The CIE for SEA/SAA is as follows:

Assessment	Maximum marks	Marks to be awarded by
Goal setting, Planning & Knowledge Acquisition	20	Nodal centre
Field work	40	Nodal centre
Demonstration/Presentation	20	Nodal centre
Report submission	20	Faculty counsellor
Total	**100**	**-**

Note:

(a) **Presentation/ Demonstration:** It is mandatory for the student to appear for demonstration and (or) oral presentation oral presentation to qualify for course evaluation. In case of presentation, student should prepare PPT with informative slides including the geo tagged photos of his/her field trips/interactions as per the schedule notified by the nodal centre. In case of demonstration, student must take timeslot from the nodal centre and demonstrate the skills learnt/improved during the allotted timeslot.

- The necessary arrangements for demonstration shall be looked after the student in consultation with the coordinator with due permission from Head of the department.

(b) **Report:** Each student is required to submit a well-documented report on the chosen SEA/SAA topic as per the format specified by *department level SEA/SAA coordinator.*

(c) **Anti-Plagiarism Check:** The SEA/SAA report should clear plagiarism check as per the Anti-Plagiarism policy of the institute.

(d) **Requirements for passing the course:** A student is deemed to have passed SEA/SAA if he/she

a. successfully demonstrates/presents the skills attained at the end of

course as per the schedule notified by the nodal centre, **and**

b. scores a minimum of 40 marks in the CIE of the course

(e) **Supplementary examination:** If a student fails in SEA/SAA activity of a particular semester, he must complete the same by enrolling it in the next higher semesters.

Course Learning Outcomes (COs):

After completion of this course, the students should be able to…

CO1: integrate the five dimensions of physical, emotional, cognitive, spiritual and social aspects in life for holistic development and demonstrate social sensibility

CO2: interact effectively through written, oral and nonverbal communication with external-world in a professional, sensitive and culturally relevant manner

CO3: analyse the issues related to social empowerment / self-accomplishment, demonstrate problem-solving skills, articulate solutions and demonstrate social sensibility

CO4: demonstrate the generic competencies in making a well-documented report and an effective oral presentation with PPTs portraying knowledge, skills, qualities acquired through fieldwork/practice sessions and social impact of the course learning

Text / Reference book(s):

For knowledge acquisition, students shall refer to textbooks and web resources relevant to the course selected. Plan for fieldwork/practice sessions in coordination with SEA/SAA coordinator

Course Articulation Matrix (CAM):		**U24VA109: SOCIAL EMPOWERMENT ACTIVITY / SELF ACCOMPLISHMENT ACTIVITY (SEA-I /SAA-I)**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24VA109.1**	1	1	-	-	-	2	2	3	2	2	1	1	1
CO2	**U24VA109.2**	1	1	-	-	1	2	1	2	2	3	1	1	1
CO3	**U24VA109.3**	1	2	1	1	-	3	2	3	2	2	1	1	1
CO4	**U24VA109.4**	1	2	-	1	2	2	1	2	2	3	2	1	1
U24A109		**2**	**1.00**	**1.50**	**0.25**	**0.50**	**0.75**	**2.25**	**1.50**	**2.50**	**2.00**	**2.50**	**1.25**	**1.00**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement (The student should be able to…)**	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	integrate the five dimensions of physical emotional cognitive spiritual and social aspects in life for holistic development and demonstrate social sensibility	SDG 3, SDG 4	Good Health and Well-being; Quality Education	Promotes holistic development well-being and lifelong learning
CO2	interact effectively through written oral and nonverbal communication with the external world in a professional sensitive and culturally relevant manner	SDG 4, SDG 16	Quality Education; Peace Justice and Strong Institutions	Develops effective communication cultural awareness and responsible citizenship
CO3	analyse the issues related to social empowerment self accomplishment demonstrate problem solving skills articulate solutions and demonstrate social sensibility	SDG 5, SDG 10, SDG 16	Gender Equality; Reduced Inequalities; Peace Justice and Strong Institutions	Encourages social inclusion equality problem solving and responsible participation in society
CO4	demonstrate the generic competencies in making a well documented report and an effective oral presentation with PPTs portraying knowledge skills qualities acquired through fieldwork practice sessions and social impact of the course learning	SDG 4, SDG 17	Quality Education; Partnerships for the Goals	Strengthens professional communication documentation and collaboration through experiential learning

EXPERT TALK SERIES-I			
Class: B.Tech. I -Semester	**Branch:** Common to all branches		
Course Code:	**U24AE110**	**Credits:**	**1**
Hours/Week (L-T-P-O-E):	**0-0-0-1-1**	**CIE Marks:**	**100%**
Total Number of Teaching Hours:	**-**	**ESE Marks :**	**-**

Course Learning Outcomes (COs):

After completion of this course, the students should be able to…

CO1: identify real-world problems, different career paths, industry requirements, emerging job roles, business practices and exploit new opportunities by staying up-to-date with industry knowledge, trends and technology

CO2: identify what 21st century employability-related skills and professional etiquette are must in a range of recruitment situations, what skills are absent in him/her, and demonstrate skill improvement

CO3: interact with experts, exhibit confidence, demonstrate improved communication and networking abilities potentially leading to mentorship opportunities, internships, or even future job prospects

CO4: demonstrate the generic competencies in making a well-documented report portraying knowledge, skills, qualities acquired through ETS sessions and impact of the expert talks

In the 21st century, for successful career, degree alone won't suffice. Competencies are much more important.

(a) You need to be aware of the real-world problems, industry working style, need to be confident and smart and you also need to know the tricks of the trade.

(b) Learning from industry experts with real-world examples, is important to enhance your educational experience.

(c) Enhanced graduate employability benefits all stakeholders. To effectively enhance employability and the immediacy of adding value to company/project, it is important that you are aware of what you are learning and its use in the workplace. The cognitive abilities viz., remember, understand, recall, and application of knowledge and other skills acquired in higher education can be maximised if you are clear on the purpose of your developed competencies and how to apply them in a range of complex situations.

(d) Graduate employability could be enhanced through fostering lifelong learning, the development of a range of employability-related competencies and increased confidence and capacity in "reflecting on and articulating these capabilities and attributes in a range of recruitment situations".

But how would you know all this without venturing into the industry?

(e) The answer is Industry **Expert Talk Series (ETS)**. Through ETS, we invite industry experts in different fields to deliver talks and interact with students.

(f) Through Industry expert talks students get to know so much more that textbooks don't explain.

(g) Students have the opportunity to learn from professionals who have achieved success in their respective fields. These speakers often share their personal experiences, case studies, and anecdotes, providing students with real-world examples and perspectives that go beyond theoretical concepts.

(h) Our competency-focussed curriculum URR24 is designed to contribute greatly to the nurturing and development of each of these facets among students through ETS courses

(i) ETS helps students gain improved industry engagement for an easier transition into the workplace, broader career progression opportunities and personal development.

(j) In URR24 curriculum, Expert talk series (ETS) is offered as a course under **ability enhancement category of courses**.

(k) Through ETS sessions, students get the chance to interact with industry regularly which helps them focus on the needs and requirements of current industry. This will not only enthuse the students with new ideas but also motivate them to understand what kind of 21st century skills are needed in industry and how they need to groom themselves.

(l) Through ETS sessions, another benefit is that students learn the importance of soft skills like communication, presentation, email etiquettes, corporate grooming and dressing styles. Conversing with successful people is the biggest motivation and students gain in more ways than one through ETS sessions.

(m) ETS enhances your learning in many ways for global opportunities for your career.

(n) All in all, learning from industry experts**,** is a wonderful opportunity for student to getting acquainted with professional etiquette, acquiring professional knowledge, and getting to know the internal workings of an organization.

(o) Salient features of ETS are hereunder:

(i) ETS is offered from I semester to VI semester.

(ii) ETS, in any given semester, is treated as one credit course

(iii) Students are required to earn six credits (from I to VI semester)

(iv) **Head, Centre for i²RE** shall be the **institute level ETS coordinator**

(v) Under this course, a minimum of 10 expert talks shall be organized in **online/offline mode** by the parent department / Centre for i²RE.

(vi) Each expert talk shall be for a minimum duration of 45 minutes (*but not exceeding 90 minutes*) followed by **online quiz/test** for 10 marks (10 MCQs/FiBs , *duration: 10-15 mins*), on the contents covered in the expert talk.

(vii) **The Head C-i²RE** shall share the marks obtained by the students in each of the quizzes / tests to the respective **department ETS coordinators.**

(viii) Each student shall attend a minimum of 6 expert talks and attempt the corresponding quizzes/ tests conducted at the end of the talks.

(ix) **Report on ETS:** At the end of semester, the student shall submit a well-documented report on the acquired knowledge and skills, in the prescribed format, to the department ETS coordinator.

(x) **Evaluation:** There shall be only continuous Internal Evaluation (CIE) for ETS for a maximum of 100 marks

(xi) The department ETS coordinator shall, in coordination with institute level ETS coordinator, submit the final scores to the CoE in week (N+1).

(p) The CIE for ETS is as follows:

Rubrics for evaluation of ETS

Quiz score	60 marks

(*sum of best 6 quiz scores out of 10 quizzes. Each quiz evaluated for 10 marks*)	
Attendance (*out of 10 quizzes*)	20 marks
Report in prescribed format (*max 30% plagiarism*)	20 marks
Total	100 marks

i. **Attendance**: Maximum of 20 marks shall be awarded based on the attendance maintained by the student over a maximum of 10 lectures.

$$Marks\ for\ attendance = \frac{Number\ of\ expert\ talks\ attended\ fully}{10} * 20$$

ii. Supplementary Exam:

(a) Student has to register for ETS supplementary examination if he/she scores less than 40 marks in CIE

(b) The ETS supplementary examination shall be conducted by the parent department, in physical mode, for 100 marks (MCQs/FiBs , *duration: 2Hrs*) on the content covered in ETS lectures.

(c) Department ETS coordinator shall, in coordination with the institute level ETS coordinator, conduct the supplementary exam, and submit scores to the CoE

(d) Exam material/resources for supplementary: Recorded videos of ETS arranged for that semester, which shall be made available on ETS webpage of institute website

II SEMESTER

Stream-II

S. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	C
1	BSC	U24MH201	Matrix Theory and Vector Calculus	2	1	-	6	9	3
2	BSC	U24PY202B	Engineering Physics	2	1	2	5	10	4
3	PCC	U24IN203	Computer Architecture and Organisation	2	1	-	4	7	3
4	ESC	U24IN204	Data Structures through C	2	1	2	5	10	4
5	ESC	U24EE205B	Basic Electrical Engineering	2	1	2	5	10	4
6	VAC	U24CY206	Environmental Studies	2	-	-	2	4	-
7	AEC	U24AE207	Idea Lab Makerspace	-	-	2	2	4	1
8	SEC	U24SE208	Programming Skill Development (PSD) Lab - 1	-	-	2	2	4	1
9	ELC	U24EL209	Practicum-2	-	-	-	4	4	1
10	VAC	U24VA210XXXXX	SEA-2 / SAA -2	-	-	-	2	2	1
11	AEC	U24AE211	Expert Talk Series-2	-	-	-	1	1	1
			Total:	12	5	10	38	65	23
Summer/ Inter-semBridge Courses (Approved by BoS and Dean,AA): 1 week to 10 days: 1 credit to each Bridge course under additional learning (will be printed on grade sheet)									

Pool – I (Physics)		
S. No.	Course Code	Course Title
1.	U24PY202A	Engineering Physics *(for Mechanical Engineering)*
2.	U24PY202B	Engineering Physics *(Common to CSM, CSD, CSN, CSO & IT)*

Pool – II (Basic Electrical & Electronics Engineering)		
S. No.	Course Code	Course Title
1.	U24EE205A	Basic Electrical and Electronics Engineering *(for Mechanical Engineering)*
2.	U24EE205B	Basic Electrical Engineering *(Common to CSM, CSD, CSN, CSO&IT)*

Courses for exit:

Successful completion of twosubjects (6-Credits)during2-months internship at the institute
OR
Successful completion of twosuitable skill based courses (external) to qualify for Certification

A. After First Year: (UG Certificate in CSE(IOT))

(i) The candidate should pass any two of the following additional courses (ITI Level) during the 2-Months internship at institute

Exit Options to Qualify for UG Certificate in CSE(IOT): Any Two (02) Courses during the 2 - Months internship									
S. No.	Category	Course Code	Course Title	L	T	P	O	E	C
1	PCC	U24IN212X	Arduino Programming	2	-	2	-	4	3
2	PCC	U24IN213X	Web Development	2	-	2	-	4	3
3	PCC	U24IN214X	Raspberry Pi Programming	2	-	2	-	4	3

(OR)

(ii) Any two suitable skill based courses to qualify for Certification.

Exit Options to Qualify for UG Certificate in CSE(IOT): Any Two (02) Skill based Courses -:									
S. No.	Category	Course Code	Course Title	L	T	P	O	E	C
1	SEC	U24SE212X	**Programming with C++** **Reference:** https://trainings.internshala.com/c-plus-plus-course	-	-	6	-	6	3
2	SEC	U24SE213X	**Advance Excel** https://trainings.internshala.com/excel-course	-	-	6	-	6	3
3	SEC	U24SE214X	**CISCO: IT Essentials** **Reference:** Offered by CISCO CoE, KITSW	-	-	6	-	6	3
4	SEC	U24SE215X	**CISCO: Introduction to Networks** **Reference:** Offered by CISCO CoE, KITSW	-	-	6	-	6	3

MATRIX THEORY AND VECTOR CALCULUS			
Class: B.Tech. II -Semester		**Branch:** Common to all branches	
Course Code:	**U24MH201**	**Credits:**	**3**
Hours/Week (L-T-P-O-E):	**2-1-0-6-9**	**CIE:**	**60 %**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40 %**

Course Learning Outcomes (COs):

After completion of this course, the students should be able to…

CO1: analyze eigen value problems using matrix theory

CO2: apply basic concepts of multiple integrals in evaluating physical quantities of real-life engineering problems

CO3: apply differential operators on vector and scalar point functions

CO4: solve line, surface, volume integrals and correlate these with applications of Green, Stoke and Gaussdivergence theorems

UNIT-I	9 Hrs

Matrices:

Rank of a Matrix, Elementary transformations of a matrix,Gauss Jordan method of finding the inverse, Normal form of a matrix, Consistency of linearsystem of equations, System of linear homogenous equations,Eigen values, Eigen vectors, Properties of Eigen values, Cayley Hamilton's theorem, Reduction to diagonal form, Factorization method (LU Decomposition)
Applications of Eigen value problems: Stretching of an elastic membrane, Eigenvalue problems arising from Markov processes, Eigenvalue problems arising from population models, Leslie model

Self-Learning Topics (SLTs): *Review of Matrices [Text 1: topics 2.1,2.2,2.3,2.4,2.5]*
PAQ –Normal form [Text 1, topic 2.7(7), Solved problems: 2.26, Practice problems: exercise 2.4 (9,10)]
Additional problems on System of homogeneous and non-homogeneous equations [Text 1: topic 2.18, Solved problems: 2.52, Practice problems: exercise 2.10 (13,14)]
Additional problems on Eigen values and Eigen vectors [Text 2: topic 8.1, Solved problems: 8.1(1,2), Practice problems: exercise 8.1(4,6)]
Nature of Quadratic form [Text 1: topic 2.18, Solved problems: 2.52, Practice problems: exercise 2.10 (13,14))

UNIT-II	9 Hrs

Multiple Integrals and Beta, Gamma functions:

Double Integrals, change of order of integration, Double Integrals in polar coordinates, Area enclosed by plane curves, Triple integrals, Volumes of solids, Calculation of Mass for a plane lamina, Beta function, Gamma function, Relation between Beta and Gamma functions (without proof).

Self-Learning Topics (SLTs): *Review of integrals [Text 1: topic Appendix VII (1)*
Additional problems on change of order of integration [Text 1: topic 7.2, Solved problems: 7.4,7.6, Practice problems: exercise 7.1 (9,14))
Centre of gravity of a plane lamina [Text 1: topic 7.10, Solved problems 7.34,7.35, Practice problems: exercise 7.6 (9,10)]
Moment of Inertia of plane lamina [Text 1: topic 7.12(1,2), Solved problems: 7.37,7.38, Practice problems: exercise 7.7 (1,4)]
Additional problems on Volume of solids [Text 1: topic 7.6, Solved problem: 7.21, Practice problems: exercise 7.4 (12,25)]

UNIT-III	9 Hrs
Vector Calculus and its applications: - Vector Space, Linear dependent and independent vectors, Differentiation of vectors, Curves in space, Tangent, Principal normal, Binormal, Curvature, Torsion, Velocity and acceleration, Scalar and vector point functions, Del applied to scalarpoint functions - Gradient, Geometrical interpretation, Directional derivative, Del applied to vector point functions -Divergence, Curl, Physical interpretation ofdivergence,Physical interpretation of curl, Del applied twice to point functions, Del applied to products of point functions, Decomposition of vector valued functions ***Self-Learning Topics (SLTs):*** *Review of vectors [Text 2: topics 9.1, 9.2, 9.3]* *Vector identities [Text 1: topic 8.9, Solved problems: 8.22, 8.23, Practice problems: exercise 8.4 (13,14)]* *Additional problems on Directional derivatives [Text 1: topic 8.5(3), Solved problems: 8.13,8.14, Practice problems: exercise 8.3 (4,6,8,9)]*	
UNIT-IV	**9 Hrs**
Integration of vectors: Lineintegral, Surfaces-Surface integral,flux across a surface, Green's theorem in the plane(without proof), Stoke's theorem (Relation between line and surface integrals)(without proof), Volume integral, Gauss divergence theorem (Relation between surface and volume integrals) (without proof), irrotational fields, solenoidal fields ***Self-Learning Topics (SLTs):*** *Additional problems on Green's theorem [Text 1: topic 8.13, Solved problems: 8.33,8.35, Practice problems: exercise 8.8 (1,2,4)]* *Additional problems on Stoke's theorem [Text 1: topics 8.14, Solved problems: 8.39, 8.40, Practice problems: exercise 8.9 (1,2)]* *Additional problems on Gauss Divergence theorem [Text 1: topic 8.16, Solved problems: 8.44,8.46, Practice problems: exercise 8.10 (1,2)]*	
Textbook(s): 1. Grewal, B.S., *Higher Engineering Mathematics*, Khanna Publishers, Delhi, 44th edition, 2017 (Chapters 2,7,8) 2. Kreyszig E, *Advanced Engineering Mathematics*, Inc, U.K, John Wiely &sons, 10th edition, 2020 (Chapter 8(8.2))	
Reference Book(s): 1. Spiegel M, *Vector Analysis* -Schaum's Series, McGraw Hill,2nd edition, 2017 2. S.S. Sastry, *Engineering Mathematics, Vol.II,* Prentice Hall of India, 3rd edition, 2014. 3. Gilbert Strang, *Introduction to Linear Algebra*, Wellesley-Cambridge Press, 5th edition	
Web and Video link(s): 1. https://youtu.be/L4crGhtEX14?si=hyjAPgDheJOhXtYZ : *NPTEL Video Lecture on Matrix Analysis with Applications/Dr.S.K.Gupta and Dr.Sanjeev Kumar/IIT Roorkee* 2. https://youtu.be/ksS_yOK1vtk?si=CNNA58OIuszubPiX: *NPTEL Video Lecture on Integral and Vector Calculus./Prof.Hari Shankar Mahato / IIT Kharagpur*	

Course Articulation Matrix (CAM):		U24MH201:MATRIX THEORY AND VECTOR CALCULUS												
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24MH201.1	2	2	1	1	-	-	-	1	1		1	1	1
CO2	U24MH201.2	2	2	1	1	-	-	-	1	1		1	1	1
CO3	U24MH201.3	2	2	1	1	-	-	-	1	1		1	1	1
CO4	U24MH201.4	2	2	1	1	-	-	-	1	1		1	1	1
U24MH201		**2**	**2**	**1**	**1**	**-**	**-**	**-**	**1**	**1**		**1**	**1**	**1**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement (The student should be able to…)**	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	analyze eigen value problems using matrix theory	SDG 4	Quality Education	Matrix theory and eigenvalue analysis strengthen mathematical reasoning, computational skills, and problem-solving abilities essential for higher education, engineering, and scientific research
CO2	apply basic concepts of multiple integrals in evaluating physical quantities of real-life engineering problems	SDG 9	Industry, Innovation and Infrastructure	Multiple integrals are widely used in engineering applications such as fluid mechanics, thermodynamics, structural analysis, image processing, computer graphics, data modeling, probability distributions, and optimization techniques, supporting technological innovation and infrastructure development
CO3	apply differential operators on vector and scalar point functions	SDG 9	Industry, Innovation and Infrastructure	Differential operators such as gradient, divergence, and curl are fundamental in fluid dynamics, electromagnetism, computational modeling, engineering simulations, and scientific research, contributing to technological advancement and innovation
CO4	solve line, surface, and volume integrals and correlate these with applications of green's, stoke's, and gauss divergence theorems	SDG 9	Industry, Innovation and Infrastructure	Vector integration techniques and integral theorems are extensively used in engineering analysis, fluid mechanics, electromagnetics, computer graphics, image processing, simulation systems, artificial intelligence, and data visualization, enabling innovative engineering solutions

ENGINEERING PHYSICS			
Class: B.Tech. II- Semester		**Branch:**Common to CSM, CSD, CSN, CSO & IT	
Course Code:	**U24PY202B**	**Credits:**	**4**
Hours/Week (L-T-P-O-E):	**2-1-2-5-10**	**CIE:**	**60%**
Total Number of Teaching Hours:	**60 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs):

After completion of this course, the students should be able to,

CO1:evaluate properties of lasers and optical fibre parameters

CO2:calculate the electric field, electric potential, magnetic field and flux density, determine properties ofmagnetic and superconducting materials

CO3:evaluate the energyvalues of a particle in an infinite potential well and apply the quantum principles in quantum computing

CO4:analyze V-I characteristics of semiconductor diodes and suggest their applications, determine resistances of transistor biasing circuits

CO5:measure diameter of wire and hollow tubes using Vernier callipers and screw gauge

CO6: determine the width of a narrow slit and wavelength of laser using diffraction phenomenon and numerical aperture of an optical fiber

CO7: calculate the dielectric constant of a materialand plot the hysteresis curve of ferromagnetic material

CO8: determine forward voltage and currents from V-I characteristics of semiconductor diodes, identify cut-off, saturation and active regions ofNPN transistor

THEORY COMPONENT

UNIT-I	9 Hrs

Applied Optics and Lasers: Principles of interference,Diffraction phenomena and applications (qualitative), Difference between conventional light and laser,Basic principles and characteristicsof lasers, Absorption,Spontaneous and stimulated emission,Population inversion, Pumping methods, Optical resonator,Types of lasers- Ruby laser, He-Ne laser, Diode laser, Applications of lasers

Fiber Optics: Introduction,Total internal reflection,Optical fiber construction,Numerical aperture and acceptance angle,Types of optical fibers - Step index and graded index, Single and multimode,V-number,Power losses in optical fibers - Attenuation, Dispersion, Bending,Fiber optic communication system,Applications of optical fibers –Endoscopy,Fiber optic sensors (temperature and displacement)

Self Learning Topics (SLTs):*Concept of waveand basic concepts-amplitude, wavelength, frequency, phase, phase angle and general wave equation(Text1: topic1.9),types of waves(Text1: topic 1.10), reflection laws(Text1: topic1.11).*

UNIT-II	9 Hrs

Electrostatics and Magnetostatics: Electric charges, Coulomb's law, Electric field, Electrostatic potential, Computation of electric field and electrostatic potential due to point and line charges,Magnetic field, Magnetic flux density, Biot-Savart's law, Ampere's law, Faraday's law and Lenz's law

Magnetic and Superconducting materials:
Introduction,Permeability,Magnetization,Susceptibility,Origin of magnetism,Bohr magneton,Ferro, Antiferro and ferri magnetic materials,Hysteresis, Soft and hard magnetic

materials and their applications, superconductivity, Meissner effect,Transition temperature,Isotope effect,Type-I and type-II superconductors,High T_c superconductors,Applications of superconductors

SelfLearning Topics (SLTs):*magnetisation, susceptibility& their relations (Text1: topic 41.2), London penetration depth (Text1: topics 42.4.7), Solved problems (Text1: Prob 42.9 to 42.14).*

UNIT-III	**9 Hrs**

Elements of Quantum Mechanics: Wave-particle duality, de-Broglie wavelength, Physical significance of wave function, Schrodinger time-dependent wave equation, Schrodinger time-independent wave equation, Particle in an infinite potential well (one dimension)

Introduction to Quantum Computing: Observables and operators, Expectation values, Expectation values in operator notation, Dirac Bra-Ket notation, Superposition principle, Concept ofQuantum bits, Classical versus Quantum computing, Quantum parallelism and Quantum entanglement, Applications of quantum computing

Self Learning Topics (SLTs): *Heisenberg's uncertainty principle (Text1: topics 27.2), Observables and operators (Text1: topics 27.19),Solved problems (Text1: Prob 27.13, Prob 27.17).*

UNIT-IV	**9 Hrs**

Semiconductor Physics: Classification of solids based on energy band theory-Conductors, Semiconductors and insulators,Intrinsic semiconductor- carrier generation and recombination,Extrinsic semiconductors- n-type and p-type (qualitative)

Semiconductor Diodes and Bipolar Junction Transistors (BJTs): Formation of a PN junction,Forward and reverse bias, PN junction diode,Diode current equation, Zener diode,Zener diode as voltage regulator and theirV-I characteristics, Light emitting diode (LED), Transistor structure, Representation of NPN and PNP transistors, Transistor action, Transistor configurations- Common base(CB), Common emitter(CE) and Common collector(CC),Corresponding α, β, γparameters and their relations and transistor as an amplifier

Self Learning Topics (SLTs):*drift & diffusion current (Text2: topic 4.9), diode current equation (Text2: topic 4.15), Solved problems (Text2: Prob 4.17 to 4.21).*

LABORATORY COMPONENT

List of Experiments

1. Linear Measurements using Vernier callipers and screw gauge
2. Determination of slit width using He-Ne laser
3. Determination of wavelength of He-Ne laser using reflection and transmissiondiffraction grating
4. Determination of dielectric constant of materials using parallel plate capacitor
5. Magnetic hysteresis- B-H curve tracing using CRO
6. Numerical aperture and acceptance angle of an optical fiber
7. Study of V-I characteristics of PN junction diode
8. Study of V-I characteristics of LED
9. Study of common emitter characteristics of NPN transistor
10. Energy band gap of a semiconductor material
11. Determination of thickness of thin sheet using air-wedge method
12. Determination of Planck's constant

Textbook(s):

1. M. Avadhanulu and Kshirsagar, TVS Arun Murthy, *A Text Book of Engineering Physics,*

S. Chand & Company Ltd, 11thedition, 2018(Unit-I, II & III- Chapter 5, 6, 27, 41, 42, 44 & 47)

2. S Salivahanan, N Suresh Kumar, *Electronic devices and circuits,* Mc Graw Hill edition, 2017 (Unit-IV-Chapter 4, 5 & 6) (Unit-IV-Chapter 4, 5 & 6)
3. Michael Nielsen and Isaac Chuang, *Quantum Computation and Quantum Information,* Cambridge University Press, 2010(Unit-III-Chapter 1.1, 1.2 & 1.3)

Reference Book(s):

1. Neil Gershenfeld, *Physics of Information Technology*, Cambridge University Press, 1stedition, 2000
2. V. Rajendran, *EngineeringPhysics*,McGrawHilledition, 2013
3. Eleanor Rieffel and Wolfgang Polak, *Quantum Computing: A Gentle Introduction,* The MIT Press Cambridge, Massachusetts London, England, 2011
4. R.K. Gaur and S.L.Gupta, *Engineering Physics*, Dhanpath Rai and Sons, 2013
5. David Halliday, Robert Resnick and S Krane, *Physics Volume I&II*, Wiley India Limited, 5thedition, 2014

Web and Video link(s):

1. https://onlinecourses.nptel.ac.in/noc24_ph28/preview, NPTEL *video lecture on Concepts in Magnetism and Superconductivityby Prof. Arghya Taraphder IIT Kharagpur*
2. https://onlinecourses.nptel.ac.in/noc24_lw07/preview, *NPTEL video lecture onIntroduction to Law on Electricity by Prof. Uday Shankar, IIT Kharagpur*
3. https://onlinecourses.nptel.ac.in/noc24_ph45/preview, *NPTEL Video Lecture on Introduction to LASER - Course by Prof. M. R. Shenoy, IIT Delhi*
4. https://onlinecourses.nptel.ac.in/noc20_ee77/preview, *NPTEL Video Lecture on Semiconductor Devices and Circuits By Prof. Sanjiv Sambandan, IISc Bangalore*
5. https://nptel.ac.in/courses/106106232, *NPTEL Video Lecture on Introduction to Quantum Computing: Quantum Algorithms and Qiskit by Prof. Prabha Mandayam, Prof. Anupama Ray, Prof. Sheshashayee Raghunathan, IIT Madras*

Laboratory Manual (for laboratory component):

1. *Engineering Physics Laboratory Manual& Record Book,* Department of PS, KITSW
2. A.K.Katiyar, C.K.Pandey, *Engineering Physics Theory and Practical,* Wiley India Pvt. Ltd,2ndedition, 2017

Course Articulation Matrix (CAM):		**U24PY202B- ENGINEERING PHYSICS**												
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO1**	**PSO 2**
CO1	**U24PY202B.1**	2	1	1	-	-	1	1	1	1	-	1	-	-
CO2	**U24PY202B.2**	2	1	-	-	-	1	1	1	1	-	1	-	-
CO3	**U24PY202B.3**	2	1	-	-	-	1	1	1	1	-	1	-	-
CO4	**U24PY202B.4**	2	1	-	-	-	1	1	1	1	1	1	-	-
CO5	**U24PY202B.5**	2	1	1	-	1	1	1	1	2	-	1	-	-
CO6	**U24PY202B.6**	2	1	-	-	1	1	1	1	2	-	1	-	-
CO7	**U24PY202B.7**	2	1	-	-	1	1	1	1	2	-	1	-	-
CO8	**U24PY202B.8**	2	1	-	1	1	1	1	1	2	1	1	-	-
U24PY202B		**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1.5**	**1**	**1**	**-**	**-**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement (The student should be able to…)**	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	evaluate the properties of lasers and optical fibre parameters	SDG 9	Industry, Innovation and Infrastructure	Develops knowledge of laser and optical fibre technologies that are fundamental to modern communication, sensing, and industrial applications
CO2	calculate the electric field, electric potential, magnetic field and flux density, and determine the properties of magnetic and superconducting materials	SDG 7	Affordable and Clean Energy	Enhances understanding of electromagnetic principles and advanced materials used in efficient energy systems and electrical technologies
CO3	evaluate the energy values of a particle in an infinite potential well and apply quantum principles in quantum computing	SDG 9	Industry, Innovation and Infrastructure	Promotes innovation by introducing emerging technologies such as quantum computing and advanced material science
CO4	analyze v-i characteristics of semiconductor diodes, suggest their applications, and determine the resistances of transistor biasing circuits	SDG 9	Industry, Innovation and Infrastructure	Develops knowledge of semiconductor devices that form the foundation of modern electronics and communication systems
CO5	measure the diameter of wires and hollow tubes using vernier calipers and screw gauge	SDG 4	Quality Education	Strengthens practical laboratory skills and precision measurement techniques through hands-on experimentation
CO6	determine the width of a narrow slit and wavelength of a laser using diffraction and determine the numerical aperture of an optical fibre	SDG 9	Industry, Innovation and Infrastructure	Provides practical exposure to optical technologies widely used in communication, healthcare, and industrial applications
CO7	calculate the dielectric constant of a material and plot the hysteresis curve of a ferromagnetic material	SDG 7	Affordable and Clean Energy	Enhances practical understanding of material properties used in energy storage, electrical devices, and efficient power systems
CO8	determine forward voltage and current from the v-i characteristics of semiconductor diodes and identify cut-off, saturation, and active regions of an npn transistor	SDG 9	Industry, Innovation and Infrastructure	Develops practical skills in semiconductor device characterization, supporting innovation in electronic circuit design and industrial applications

COMPUTER ARCHITECTURE AND ORGANIZATION			
Class: B.Tech. II –Semester		**Branch:**CSE (Internet of Things)	
Course Code:	**U24IN203**	**Credits:**	**3**
Hours/Week (L-T-P-O-E):	**2-1-0-4-7**	**CIE:**	**60 %**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40 %**

Course Learning Outcomes (COs):

After completion of this course, the students should be able to,

CO1: analyze instruction formats and addressing modes of assembly language

CO2: examine hardwired & CISC style processors and solve arithmetic operations using signed and unsigned integers

CO3: assess cache memory mapping techniques and examine data transfer between processor, memory & I/O

CO4: evaluate different modes of data transfer, classify interconnection structures

UNIT-I	**9 Hrs**

Basic Structure of Computers: Functional units, basic operational concepts, performance of computer.

Instruction Set Architecture: Memory locations and addresses, memory operations, instructions and instruction sequencing, instruction formats, addressing modes, assembly language, and assembler directives.

Self Learning Topics (SLTs): Digital computers(Text2:topic 1),Complement of a function(Text2:Topic 1.3)

UNIT-II	**9 Hrs**

Basic Processing Unit: Fundamental concepts, instruction execution, hardware components, Instruction fetch and execution steps, control signals, hard-wired control, CISC-style processors

Arithmetic: Addition and subtraction of signed numbers, multiplication of unsigned numbers, multiplication of signed numbers, fast multiplication, integer division, floating-point numbers and operations

Self Learning Topics(SLTs): Number Representation and Arithmetic Operations(Text1: topic 1.4.1 & 1.4.2),Boolean Algebra(Text2:Topic 1.3)

UNIT-III	**9 Hrs**

The Memory System: Basic concepts, semiconductor RAM memories-Internal organization of memory chips, static memories, dynamic RAMs, read-only memories, memory hierarchy, cache memory mapping functions, performance considerations, secondary storage

Input-Output Organization: Input-output interface-I/Obusandinterfacemodules,I/Ovs memory bus, Isolated vs. memory-mapped I/O, asynchronous data transfer- strobe control, handshaking,asynchronous serial transfer

Self Learning Topics(SLTs):Register Transfer Language(Text2:Topic 4.1),Bus and Memory transfers(Text2:Topic 4.3)

UNIT-IV	**9 Hrs**

Modes of Transfer: Modes of transfer, priority interrupt, direct memory access, interconnection standards

Pipeline and Vector Processing: Parallel processing, pipelining, arithmetic pipeline, instruction pipeline, vector processing

Multi Processors: Characteristics of multiprocessors, Interconnection structures

Self Learning Topics(SLTs):Common Bus System(Text1:Topic 5.2)

Textbook(s):

1. CarlHamacher,ZvonkoVranesic,SafwatZaky,Naraig Manjikian, Computer Organization and Embedded Systems, 6thed.,New Delhi: McGraw-HillEducation,2012. (Chapters1,2,5,7-9)
2. Morris Mano, Digital Design, PHI, 3rd edition, 2003, New Delhi.
3. David B.Kirk and Wen-meiW.Hwu,Programming Massively Parallel Processors A Hands-on Approach, 2nded.,USA: Morgan Kaufmannisanim print of Elsevier,2013.(Chapters1,2)

Reference Book(s):

1. B Ram, Sanjay Kumar, Computer Fundamentals: Architecture and Organization, 5th ed., New Delhi: New Age International Publishers, 2018.
2. W. Stallings, Computer Organization and Architecture - Designing for Performance, 7th ed., New Delhi: Pearson Education, 2009.
3. John P. Hayes, Computer Architecture and Organization, 3rd ed., New Delhi: McGraw-Hill Education, 1998.
4. Vincent P.Heuring, Harry F.Jordan, Computer Systems Design and Architecture, 2nd ed., United States: Pearson Education, 2004.

Web and Video link:

https://onlinecourses.nptel.ac.in/noc20_cs64/preview

Course Articulation Matrix (CAM):		**U24IN203- COMPUTER ARCHITECTURE AND ORGANIZATION**												
Course Outcomes		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	U24IN203.1	2	2	2	1	-	1	1	1	-	1	1	1	1
CO2	U24IN203.2	2	2	2	2	-	1	1	1	-	1	1	1	1
CO3	U24IN203.3	2	2	2	2	-	1	1	1	-	1	1	2	1
CO4	U24IN203.4	2	2	2	2	-	1	1	1	-	1	1	2	1
U24IN203		2	2	2	1.8	-	1	1	1	-	1	1	1.5	1

CO–SDG Alignment Matrix				
CO	**CO Statement (The student should be able to…)**	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	analyze instruction formats and addressing modes of assembly language	SDG 4	Quality Education	Develops a strong foundation in computer architecture, assembly language programming, and analytical problem-solving skills
CO2	examine hardwired and cisc-style processors and solve arithmetic operations using signed and unsigned integers	SDG 9	Industry, Innovation and Infrastructure	Enhances understanding of processor design and arithmetic operations essential for modern computing systems and technological innovation
CO3	assess cache memory mapping techniques and examine data transfer between processor, memory, and i/o	SDG 9	Industry, Innovation and Infrastructure	Builds knowledge of efficient memory organization and data transfer mechanisms to improve computer system performance and infrastructure
CO4	evaluate different modes of data transfer and classify interconnection structures	SDG 9	Industry, Innovation and Infrastructure	Develops the ability to analyze computer interconnection mechanisms and data transfer techniques used in high-performance computing systems

DATA STRUCTURES THROUGH C			
Class: B.Tech. II –Semester		**Branch:** CSE (Internet of Things)	
Course Code:	**U24IN204**	**Credits:**	**4**
Hours/Week (L-T-P-O-E):	**2-1-2-5-10**	**CIE:**	**60%**
Total Number of Teaching Hours:	**60 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs):

After completion of this course, the students should be able to,

CO1: analyze and implement array operations by utilizing dynamic memory allocation and evaluating their time and space complexities

CO2: analyze and implement stack and queue data structures by utilizing array representations and evaluating their applications and operational complexities

CO3: analyze and implement various types of linked lists by utilizing dynamic memory allocation techniques and evaluating their operational complexities

CO4: develop various sorting algorithms, analyze their time complexities, and apply hashing techniques with collision resolution methods, comparing their efficiencies

CO5: develop and test basic data structures and array operations, including dynamic memory allocation to evaluate their performance and complexity

CO6: apply the linear data structures such as stacks and queues and perform various operations using LIFO or FIFO order respectively

CO7: solve problems using various linked list representations for efficiently storing and retrieving the data

CO8: apply different sorting techniques on unsorted data and sort them in an order, able to store the data using hashing techniques to retrieve the data very effectively

THEORY COMPONENT

UNIT-I	9 Hrs

Data Structures: Basic terminology, Classification of data structures, Applications and operations on data structures, Time and space complexity

Arrays: Operations on arrays-traversing an array, Inserting an element in an array, Deleting an element from an array, Searching an element using binary search and their complexities,

Dynamic Memory Allocation: Memory allocation functions, Dynamic memory allocation for single and two dimensional arrays

Self Learning Topics (SLTs): *Three dimensional and n-dimensional arrays (Text1: topics 2.4.3), passing arrays to functions and pointers (Reference1: topics 3.6, 3.7), Practice problems (Text1: Prob 2.3, Reference1: Prob 1,Prob 2,Prob 3,Prob 4)*

UNIT-II	9 Hrs

Stacks: stacks, Array representation of stacks, Operations on a stack–push and pop, Multiple stacks, Applications of stacks- recursion, Fibonacci series, tower of Hanoi, evaluation of expressions (infix to postfix conversion, evaluation of postfix expression)

Queues: queues, Array representation of queues, Double ended queues, Circular queues

Self Learning Topics (SLTs): *Infix to prefix (Reference1: topics 7.7.3), priority Queue(Reference1: 8.4.3), Solved problems (Reference1: Prob 7.7.1, Prob 7.7.2), Practice problems (Text1: Prob 4.5, Prob 4.11, Prob 5.7, Prob 5.9)*

UNIT-III	9 Hrs
Linked Lists: Basic terminologies, Linked list versus arrays, Memory allocation and de-allocation for a linked list, Singly linked list, Circular linked list, Doubly linked list, Circular doubly linked list (linked list operations- traversing, searching, inserting, deleting), Representing stack and queue using linked list ***Self Learning Topics (SLTs):*** *Merging (Text1: topics 3.3), Skiplist (weblink: https://www.geeksforgeeks.org/skip-list/), Deallocation strategy(Text1: topic 3.9), Solved problems (Text1: Prob 3.6.1, Prob 3.6.2), Practice problems (Reference1: Prob 5.5, Prob 5.7, Prob 5.9)*	
UNIT-IV	**9 Hrs**
Sorting Techniques: Selection sort, Insertion Sort, Shell sort and radix sort, Time complexities of sorting **Hashing:** Hashing techniques, Collision resolution techniques, Closed hashing, Open hashing, Comparison of collision resolution techniques **Self Learning Topics (SLTs):** Two way insertion sort *(Text1: topics 10.3.4), Comparison of sorting techniques(Reference1: topics 14.16) Solved problems (Reference1: Prob 15.5, Prob 15.6, Prob 15.7), Practice problems (Text1: Prob 6.4)*	

LABORATORY COMPONENT

List of Experiments

Experiment-I

1. Program to implement initialization of array and perform traversal operations in both the directions
2. Program to implement searching operation on array using Linear Search
3. Program to display the count of occurrences of every number in an array

Experiment-II

4. Program to implement searching operation on array using Binary Search
5. Program to implement insertion operation on array
6. Program to implement deletion operations on array

Experiment-III

7. Program to implement initialization of arrays and traversal operation with DMA
8. Program to implement matrix addition and subtraction with DMA

Experiment-IV

9. Program to implement matrix multiplication with DMA
10. Program to implement stack operations
11. Program to convert infix expression into postfix

Experiment-V

12. Program to evaluate given postfix expression
13. Program to define recursive function to solve tower of hanoi puzzle
14. Program to display the Fibonacci series with the help of recursive function
15. Program to implement MultiStack

Experiment-VI

16. Program to implement queue operations using arrays
17. Program to implement circular queue operations using arrays
18. Program to implement double ended queue operations using arrays

Experiment-VII

19. Program to create single linked list and implement its operations

Note:-Linked list Operations**:** i) traversing ii) inserting iii) deleting iv) searching v) reversing vi) concatenation

Experiment-VIII

20. Program to create circular linked list and implement its operations
21. Program to create double linked list and implement its operations

Experiment-IX

22. Program to create circular double linked list and implement its operations

Experiment-X

23. Program to implement stack operations using linked list
24. Program to implement queue operations using linked list

Experiment-XI

25. Program to implement selection sort
26. Program to implement insertion sort

Experiment-XII

27. Program to implement shell sort
28. Program to implement radix sort
29. Program to implement hash table.

Textbook(s):

1. Debasis Samanta, *Classic Data Structures*, Prentice Hall India, 2nd edition, 2009

Reference Book(s):

1. Reema Thareja, *Data Structures Using C*, Oxford University Press, 2nd edition, 2014
2. Balagurusamy E, *Data Structure Using C*, McGraw Hill Education, 1st edition, 2017
3. Richard F. Gilberg and Behrouz A. Forouzan, *Data Structures: A Pseudocode Approach with C*, Cengage Learning, 2nd Edition, 2007

Web and Video link(s):

https://nptel.ac.in/courses/106106130, *NPTEL Video Lecture on Programming and Data Structures Dr. N. S. Narayana Swamy, CSE, IIT Madras.*

Laboratory Manual (for laboratory component):

1. *Data Structures through C Laboratory Manual and Record Book,* Department of CSE (AI & ML), KITSW.

Course Articulation Matrix (CAM):		U24IN204 DATA STRUCTURES THROUGH C												
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24IN204.1	2	2	2	1	-	-	-	1	-	1	1	**2**	**1**
CO2	U24IN204.2	2	2	2	2	-	-	-	1	-	1	2	**2**	**2**
CO3	U24IN204.3	2	2	2	2	-	-	-	1	-	1	2	**2**	**2**
CO4	U24IN204.4	2	2	2	2	-	-	-	1	-	1	2	**2**	**2**
CO5	U24IN204.5	2	2	2	1	-	-	-	1	1	1	1	**2**	**1**
CO6	U24IN204.6	2	2	2	2	-	-	-	1	1	1	2	**2**	**2**
CO7	U24IN204.7	2	2	2	2	-	-	-	1	1	1	2	**2**	**2**
CO8	U24IN204.8	2	2	2	2	-	-	-	1	1	1	2	**2**	**2**
U24IN204		**2**	**2**	**2**	**1.75**	**-**	**-**	**-**	**1**	**1**	**1**	**1.75**	**2**	**1.75**

CO–SDG Alignment Matrix				
CO	**CO Statement (The student should be able to…)**	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	analyze and implement array operations by utilizing dynamic memory allocation and evaluating their time and space complexities	SDG 4	Quality Education	Develops computational thinking, algorithmic analysis, and programming skills through efficient implementation of array operations
CO2	analyze and implement stack and queue data structures using array representations and evaluate their applications and operational complexities	SDG 4	Quality Education	Strengthens analytical and problem-solving skills by applying linear data structures to solve computational problems efficiently
CO3	analyze and implement various types of linked lists using dynamic memory allocation techniques and evaluate their operational complexities	SDG 9	Industry, Innovation and Infrastructure	Builds competencies in designing efficient data management techniques that support scalable and innovative software systems
CO4	develop various sorting algorithms, analyze their time complexities, and apply hashing techniques with collision resolution methods, comparing their efficiencies	SDG 9	Industry, Innovation and Infrastructure	Enhances the ability to design optimized algorithms and efficient data retrieval mechanisms essential for modern computing applications.
CO5	develop and test basic data structures and array	SDG 4	Quality Education	Reinforces programming fundamentals and

CO–SDG Alignment Matrix				
CO	**CO Statement (The student should be able to…)**	**Relevant SDG**	**SDG Description**	**Mapping Justification**
	operations, including dynamic memory allocation, to evaluate their performance and complexity			practical implementation skills through laboratory-based learnin
CO6	apply linear data structures such as stacks and queues and perform various operations using lifo and fifo principles	SDG 4	Quality Education	Develops practical problem-solving skills by implementing and testing fundamental data structures
CO7	solve problems using various linked list representations for efficiently storing and retrieving data	SDG 9	Industry, Innovation and Infrastructure	Promotes efficient data organization and retrieval techniques used in software systems and industrial computing applications
CO8	apply different sorting techniques on unsorted data and use hashing techniques for effective data storage and retrieval	SDG 9	Industry, Innovation and Infrastructure	Develops practical skills in algorithm optimization and efficient data management for high-performance software applications

BASIC ELECTRICAL ENGINEERING			
Class: B.Tech. II -Semester		**Branch:** Common to CSM, CSD,CSN.CSO & IT	
Course Code:	U24EE205B	**Credits**	**4**
Hours/Week (L-T-P-O-E):	**2-1-2-5-10**	**CIE**	**60 %**
Total Number of Teaching Hours:	**60 Hrs**	**ESE**	**40 %**

Course Learning Outcomes (COs):

After completion of this course, the students should be able to,

CO1: determine voltage, current & power in electrical circuits using network reduction techniques, mesh & nodal analysis

CO2: apply suitable network theorems to analyze DC circuits

CO3: determine impedance, voltage, current, and power in 1- Ø AC circuits & determine line and phase quantities in 3- Ø AC circuits

CO4 : select a suitable electrical machine for given applications and determine the energy consumed by a lighting load.

CO5: validate mesh and nodal analysis

CO6: validate network theorems

CO7: determine the impedance of series RL & RC circuits at various operating frequencies

CO8: determine the efficiency of a transformer by conducting a load test

THEORY COMPONENT

UNIT-I	9 Hrs

DC circuits: Network elements, Linear & non-linear elements, Active & passive elements, Unilateral & bilateral elements, Ohm's law, Power, Energy, Kirchhoff's laws, Resistances connected in series and parallel, Voltage divider rule & Current divider rule.

DC Circuit analysis: Source transformation, Star-Delta conversion, Mesh analysis & Nodal analysis (T & π networks only).

Self-Learning Topics (SLTs)*: Definitions of charge, current, & voltage (Text1: Topics1.2,), Solved problems (Text1: Prob 3.10,3.11 &3.12), Practice problems (Text1: Chap-3,Prob 4,5,7&8).*

UNIT-II	9 Hrs

DC network theorems (Independent sources only): Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem (T & π networks only).

Self-Learning Topics (SLTs): *Condition for maximum power transfer(Text1: Topics3.9), Solved problems (Text1: Prob 3.15,3.18,3.23 & 3.25), Practice problems (Text1: Chap-3,Prob 9,10,13 & 14).*

UNIT-III	9 Hrs

1-Ø **AC circuits:** R.M.S value, Average value, Peak factor and form factor of a sine wave, Concept of phasor, Phase and phase difference, Rectangular and polar form representation, Sinusoidal steady state analysis of R, L, C, Series RL, RC, RLC circuits, Concept of Reactance, Impedance, Complex power, Real Power, Reactive power and Power factor.

3- Ø **AC circuits**: Generation of 3**-** Ø voltages, Advantages, Disadvantages, Applications of a three-phase system, Voltage & current relationships of line and phase values for balanced star and delta connections.

Self-Learning Topics (SLTs): *Expression for RMS & Average value (Text1: Topic,4.4 & 4.5) Solved problems (Text1: Prob4.10,4.12,4.13 & 4.14), Practice problems (Text1: Chap-4,Prob 8,9,12&12).*

UNIT-IV	9 Hrs

Electrical Machines & Electrical Lighting (Qualitative treatment):

Construction, Principle of operation, Characteristics & applications of 1- Ø transformer, 3- Ø induction motor, 1- Ø induction motor and DC motor and Types of DC motor.

Electrical lighting sources and Energy calculations:

Lighting sources-incandescent, Fluorescent, CFL & LED lamps, Elementary calculations for energy consumption.

Self-Learning Topics (SLTs): *EMF equation of a Transformer (Text1: Part-II Topic,4.4.2) Solved problems (Text1: Part-II Prob 4.5, 4.6 & 4.7), Practice problems (Text1: Part-II Prob 5.2, 5.3 & 5.4), Practice problems (Text1: Part-II Prob 6, 7 & 8)*

LABORATORY COMPONENT

List of Experiments

1. Verification of voltage divider rule and current divider rule
2. Verification of Mesh Analysis
3. Verification of Nodal Analysis
4. Verification of Superposition Theorem
5. Verification of Thevenin's Theorem
6. Verification of Maximum power transfer Theorem
7. Determination of internal parameters of a choke coil
8. Impedance calculations and phasor representation of RL series circuit
9. Impedance calculations and phasor representation of RC series circuit
10. Load test on 1-phase transformer
11. Verification of Kirchoff's laws using PSPICE/MATLAB
12. **Interfacing Sensors with Arduino using TINKER CAD**
    i. LED blinking
    ii. IR Sensor
    iii. Ultrasonic Sensor
    iv. Voltage Sensor
    v. Current Sensor
    vi. Speed Sensor

Textbook(s):

1. K. Uma Rao, *Basic Electrical Engineering* , Pearson Education, Edition,2011

Reference Book(s):

1. B.L.Thereja, A.K.Thereja, *Electrical Technology Vol. I & II* , S.Chand & Company Ltd, Edition , 2005.
2. Edward Hughes, *Electrical & Electronics Technology* , Pearson Education, 10thEdition., 2010.
3. D. P. Kothari and I. J. Nagrath, *Basic Electrical Engineering* , Tata McGraw Hill, Edition , 2010.
4. Chakravarthy A, Sudhipanath and Chandan Kumar, *Basic Electrical Engineering* , Tata McGraw Hill Ltd, 4thEdition, 2013

Web and Video link(s):

https://nptel.ac.in/courses/108/105/108105112//, *NPTEL Video Lecture on Fundamentals of Electrical Engineering by Prof. Debapriya Das, Professor of EED, IITK Kharagpur.*

Laboratory Manual (for laboratory component):

1. *Basic Electrical Engineering Laboratory Manual and Record Book,* Department of EEE, KITSW.

Course Articulation Matrix (CAM):		U24EE205B: BASIC ELECTRICAL ENGINEERING											
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24EE205B.1	2	1	-	-	-	-	-	1	1	1	**1**	1	1
CO2	U24EE205B.2	2	2	-	-	-	-	-	1	1	1	**1**	1	1
CO3	U24EE205B.3	3	3	1	1	1		1	1	1	1	**1**	1	1
CO4	U24EE205B.4	3	3	1	1	1	1	1	1	1	1	1	1	1
CO5	U24EE205B.5	2	1	-	-	-	-	-	1	1	1	**1**	1	1
CO6	U24EE205B.6	2	2	-	-	-	-	-	1	1	1	**1**	1	1
CO7	U24EE205B.7	3	3	1	1	1		1	1	1	1	**1**	1	1
CO8	U24EE205B.8	3	3	1	1	1	1	1	1	1	1	**1**	1	1
U24EE205B		**2.5**	**2.25**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	1
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement (The student should be able to…)**	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	determine voltage, current, and power in electrical circuits using network reduction techniques, mesh, and nodal analysis	SDG 4	Quality Education	Develops fundamental knowledge and analytical skills in electrical circuit analysis through engineering principles and problem-solving
CO2	apply suitable network theorems to analyze dc circuits	SDG 4	Quality Education	Strengthens engineering problem-solving abilities by applying network theorems to practical electrical circuit analysis
CO3	determine impedance, voltage, current, and power in single-phase ac circuits and determine line and phase quantities in three-phase ac circuits	SDG 7	Affordable and Clean Energy	Builds competencies in AC power systems and efficient utilization of electrical energy, supporting sustainable energy practice
CO4	select a suitable electrical machine for given applications and determine the energy consumed by a lighting load	SDG 7	Affordable and Clean Energy	Promotes the efficient selection and utilization of electrical machines and energy-efficient lighting systems to support sustainable energy consumption
CO5	validate mesh and nodal analysis	SDG 4	Quality Education	Reinforces theoretical concepts through laboratory experiments, enhancing practical engineering and analytical skills
CO6	validate network theorems	SDG 4	Quality Education	Provides hands-on experience in verifying electrical engineering principles using experimental methods
CO7	determine the impedance of series rl and rc circuits at various operating frequencies	SDG 7	Affordable and Clean Energy	Develops practical skills in analyzing AC circuits for efficient electrical system design and energy utilization
CO8	determine the efficiency of a transformer by conducting a load test	SDG 7	Affordable and Clean Energy	Enhances practical knowledge of transformer performance and energy efficiency, contributing to sustainable electrical power systems

ENVIRONMENTAL STUDIES			
Class:B.Tech.IISemester		**Branch:**CommontoME, CSM, CSD, IT, CSN & CSO	
CourseCode:	**U24CY206**	**Credits:**	**0**
Hours/Week(L-T-P-O-E):	**2-0-0-2-4**	**CIE:**	**60%**
TotalNumberofTeachingHours:	**24Hrs**	**ESE:**	**40%**

CourseLearningObjectives(LOs):

Thiscourse willdevelopstudents' knowledgein/on…

LO1:natural resources and their usage more equitably

LO2: ecosystem and the importance of biodiversity conservation

LO3: environmental pollution and it'scontrol measures

LO4: environmental legislation and green methodology

UNIT-I	6Hrs

The Multidisciplinary Nature of Environmental Studies: Definition, Scope and importance

Natural Resources: Forest Resources-Use and over exploitation of forests, Deforestation, Timber extraction, Mining, Dams and their effects on forests and tribal people**,** Water Resources-Use and over-utilization of surface and ground water, Floods, Drought, Conflicts over water**,** Mineral Resources-Environmental effects of extracting and using mineral resources**,** Energy Resources-Renewable and non-renewable energy sources, Use of alternate energy sources

Self Learning Topics (SLTs): *Use and over-utilization of surface and ground water (Text1: unit 2, topic: 2.2.2) world food problems (Text1: unit 2, topic 2.2.2)*

UNIT-II	6Hrs

Ecosystem and Biodiversity:

Ecosystem: Concepts of an ecosystem, Food chain, Food webs, Ecological pyramids, Energy flow in the ecosystem and ecological succession

Biodiversity and its Conservation: Introduction, Definition, Genetic, Species and ecosystem diversity, Value of biodiversity, Biodiversity in India, Hot spots of biodiversity, Man-wildlife conflicts, Endangered and endemic species of India, In-situ and Ex-situ conservation

Self Learning Topics (SLTs): *Introduction and definition of biodiversity (Text1: unit 4, topic 4.1)*

UNIT-III	6Hrs

Environmental Pollution: Global issues**-**Global climatic change, Greenhouse gases, Effects of global warming, Ozone layer depletion

International Conventions/Protocols: Earth summit, Kyoto protocol, Montreal protocol

Environmental Pollution-Causes and effects of air, Water, Soil, Marine and noise pollution with case studies

Solid and Hazardous Waste Management: Introduction, Types, Effects of urban industrial and nuclear waste

Natural Disaster Management: Introduction to disaster, Management of disaster, Disaster management of flood, earthquake, cyclone and landslides

Role of information technology in environment and human health

Self Learning Topics (SLTs): *Role of individual in prevention of pollution (Text1: unit 5, topic 5.10)*

UNIT-IV	6Hrs

Social Issues and the Environment: Role of Individual and Society, Water conservation, Rain water harvesting

Environmental Protection/Control Acts: Air (prevention and control of pollution) act 1981, Forest conservation act (1980 and 1992), Wildlife protection act 1972, Environment protection act 1986, Issues involved in enforcement of environmental legislations

Green Methodology: Principles of green chemistry, Green methods in electronic production, Impact of electronic waste on public health and environment

The Sustainable Development Goals (SDGs): United Nations Sustainable Development Goals
SelfLearningTopics(SLTs):*Water (prevention and control of pollution) act 1974 (Text1: unit 6, topics 6.10), Water pollution cess act 1977 (Text1: unit 6, topics 6.11)*

CourseArticulationMatrix(CAM):		**U24CY206 ENVIRONMENTAL** STUDIES												
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	**U24CY206.1**	2	1	2	1	-	2	1	1	1	-	-	1	1
CO2	**U24CY206.2**	-	-	2	-	-	1	1	1	1	1	-	1	1
CO3	**U24CY206.3**	1	2	1	-	-	1	1	1	1	1	1	1	1
CO4	**U24CY206.4**	-	-	1	-	-	1	1	1	1	-	1	1	1
U24CY206		**1.50**	**1.50**	**1.50**	**1.00**	**-**	**1.25**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**

CO–SDG Alignment Matrix				
CO	**CO Statement (The student should be able to…)**	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	identify the natural resources and practice their usage more equitably	SDG 12, SDG 15	Responsible Consumption and Production; Life on Land	Promotes sustainable use and conservation of natural resources
CO2	develop an action plan for sustainable alternatives and conserving biodiversity	SDG 13, SDG 15	Climate Action; Life on Land	Encourages sustainable practices biodiversity conservation and environmental protection
CO3	examine and perceive the solutions for environmental pollution	SDG 6, SDG 11, SDG 13	Clean Water and Sanitation; Sustainable Cities and Communities; Climate Action	Develops solutions for pollution control to improve environmental quality and sustainability
CO4	adapt issues involved in enforcement of environmental legislation and green methodology	SDG 12, SDG 16	Responsible Consumption and Production; Peace Justice and Strong Institutions	Promotes environmental governance sustainable practices and compliance with environmental regulations

IDEA LAB MAKERSPACE			
Class: B.Tech.II -Semester		**Branch:** Common to all branches	
Course Code:	**U24AE207**	**Credits:**	**1**
Hours/Week (L-T-P-O-E):	**0-0-2-2-4**	**CIE :**	**100%**
Total Number of Lab Hours:	**36 Hrs**	**ESE :**	**-**

Course Learning Outcomes (COs):

After completion of this course, the students should be able to …

CO1: produce wooden joints and intricate articles using carpentry and CNC wood router respectively

CO2: implement procedures to prepare the mould cavity for sand casting and arc welding joints

CO3: produce innovative prototypes using laser engraving and 3D printing

CO4: design and develop systems based on PCB and IoT for given applications

S. No.	Creative Fabrication Technology	List of Experiments
1.	Carpentry	Prepare a half lap dovetail joint
2.	CNC Wood Router	Perform wood carving using CNC Wood Router
3.	Foundry	Prepare a sand mould using single piece pattern
4.	Welding	Prepare a single V-butt joint on mild steel plates using AC arc welding machine
5.	Injection Moulding	Prepare a plastic product using Injection moulding machine
6.	Laser Engraving	Perform key chain by using CO_2 laser cutting machine
7.	3D Printing	Prepare a key chain on 3D printer with the given dimensions
8.		Prepare a Spur Gear on 3D printer with the given dimensions
9.	Robotics	Perform basic pick-and-place operation using robot
10.	Printed Circuit Board (PCB)	Design and fabricate a PCB for a given application
11.	Internet of Things (IoT)	Measure the temperature and humidity by using DHT11 sensor and Arduino UNO
12.		Create a smart plant watering system using IoT
Course Project		• Students are required to create an affordable prototype as their course project, based on the knowledge and skills acquired during the course. • Students have to present and submit their prototypes to demonstrate their ability to apply classroom learning practically, showcasing their creativity and technical aptitude.

Laboratory Manual:

- ***IDEA Lab Makerspace*** *Laboratory Manual & Record Book (LMRB) prepared by the faculty of department of Mechanical Engineering, KITSW, Revised version 4, August-2024.*

Text/ Reference Book(s):

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy., "*Elements of Workshop Technology*", Media Promoters and publishers Pvt. Ltd, India, Vol-I-2008 &Vol-II-2010.

2. Ian Gibson, David Rosen, Brent Stucker, Mahyar Khorasani, "*Additive Manufacturing Technologies-3D Printing, Rapid Prototyping, and Direct Digital Manufacturing*" Springer Nature, 2nd Edition 2021.
3. R.S. Khandpur, "*Printed Circuit Boards: Design, Fabrication, Assembly and Testing*", New Delhi Tata Mc Graw Hill-2008.
4. Sudeep Mishra, Anandarupmukherjee and Arijit Roy, "*Introduction to IoT*", New Delhi: University Cambridge Press, 2021.

Course Articulation Matrix (CAM):		**U24EE207: IDEA LAB MAKERSPACE**												
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	**U24AE207.1**	2	2	1	1	2	1	-	1	2	2	1	1	1
CO2	**U24AE207.2**	2	2	1	1	2	1	-	1	2	2	1	1	1
CO3	**U24AE207.3**	2	2	1	1	2	1	-	1	2	2	1	1	1
CO4	**U24AE207.4**	2	2	1	1	2	1	-	1	2	2	1	1	1
U24AE207		**2**	**2**	**1**	**1**	**2**	**1**	**-**	**1**	**2**	**2**	**1**	**1**	**1**

CO–SDG Alignment Matrix				
CO	**CO Statement (The student should be able to…)**	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	produce wooden joints and intricate articles using carpentry and CNC wood router respectively	**SDG 4, SDG 9**	Quality Education; Industry Innovation and Infrastructure	Develops practical manufacturing skills and promotes modern production technologies
CO2	implement procedures to prepare the mould cavity for sand casting and arc welding joints	**SDG 9**	Industry Innovation and Infrastructure	Enhances manufacturing skills and industrial practices for engineering applications
CO3	produce innovative prototypes using laser engraving and 3D printing	**SDG 9**	Industry Innovation and Infrastructure	Encourages innovation rapid prototyping and advanced manufacturing technologies
CO4	design and develop systems based on PCB and IoT for given applications	**SDG 9, SDG 11**	Industry Innovation and Infrastructure; Sustainable Cities and Communities	Supports the development of smart electronic systems and IoT solutions for sustainable applications

PROGRAMMING SKILL DEVELOPMENT LABORATORY-1			
Class: B.Tech. II -Semester		**Branch:** CSE (Internet of Things)	
Course Code:	**U24SE208**	**Credits:**	**1**
Hours/Week (L-T-P-O-E):	**0-0-2-2-4**	**CIE :**	**100%**
Total Number of Lab Hours:	**36 Hrs**	**ESE :**	**-**

Course Learning Outcomes (COs):

After completion of this course, the students should be able to …

CO1: develop efficient and optimized C programs to solve a range of moderate to complex problems, demonstrating a strong understanding of programming fundamentals and algorithm design

CO2: analyze and debug C programs to identify errors and optimize code performance, employing appropriate debugging techniques and tools

CO3: apply advanced programming concepts such as dynamic memory allocation, data structures, and file handling in C to create robust and scalable solutions

CO4: design, implement, and test real-world applications in C, simulating industry scenarios and preparing for technical roles in software development and problem-solving

LABORATORY COMPONENT

S. No.	List of Experiments
1.	Programs using input output functions, operators
2.	Programs using conditional control structures: if, if-else, nested if
3.	Programs using else if ladder, switch and goto statements
4.	Programs using iterative statements
5.	Programs using iterative statements
6.	Programs on one dimensional array and two-dimensional arrays
7.	Programs on one dimensional array and two-dimensional arrays
8.	Programs on String operations and string handling functions
9.	Programs on different types of functions, parameter passing using call-by-value & call-by-address, recursion and storage classes
10.	Programs on different types of functions, parameter passing using call-by-value & call-by-address, recursion and storage classes
11.	Programs using structures, unions, pointers to arrays and pointers to strings
12.	Programs using array of pointers and pointers to structures

Text/ Reference Book(s):

1. Balagurusamy.E, *Programming in ANSI C*, McGraw Hill, 8th edition, 2022
2. Paul Deitel, Harvey Deitel, *C How to Program: With Case Studies Introducing Applications Programming and Systems Programming*, Pearson Education Limited, 9th edition, 2022
3. Brian W. Kernighan and Dennis Ritchie, *The C Programming Language*, Pearson Education India, 2nd edition, 2015
4. Reema Thareja, *Programming in C,* Oxford University Press, 3rd edition, 2023
5. Yashavant Kanetkar, *Let Us C,* BPB Publications, 19th edition, 2022
6. A.K.Sharma, *Computer Fundamentals and Programming in C,*Universities Press, 2nd edition, 2018

Course Articulation Matrix (CAM):		U24SE208: PROGRAMMING SKILL DEVELOPMENT LAB1												
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PS O1	PSO 2
CO1	U24SE208.1	2	2	1	1	1	-	-	1	1	1	1	2	2
CO2	U24SE208.2	2	2	1	1	1	-	-	1	1	1	1	2	2
CO3	U24SE208.3	2	2	1	1	1	-	-	1	1	1	1	2	2
CO4	U24SE208.4	2	2	1	1	1	-	-	1	1	1	1	2	2
U24SE208		**2**	**2**	**1**	**1**	**1**	**-**	**-**	**1**	**1**	**1**	**1**	**2**	**2**

CO–SDG Alignment Matrix				
CO	**CO Statement (The student should be able to…)**	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	develop efficient and optimized c programs to solve a range of moderate to complex problems, demonstrating a strong understanding of programming fundamentals and algorithm design	SDG 4	Quality Education	Develops programming proficiency, algorithmic thinking, and computational problem-solving skills through hands-on coding practice
CO2	analyze and debug c programs to identify errors and optimize code performance, employing appropriate debugging techniques and tools	SDG 4	Quality Education	Enhances analytical thinking, debugging, and software optimization skills essential for professional software development
CO3	apply advanced programming concepts such as dynamic memory allocation, data structures, and file handling in c to create robust and scalable solutions	SDG 9	Industry, Innovation and Infrastructure	Builds competencies in advanced software development techniques required for developing reliable, scalable, and innovative computing solutions
CO4	design, implement, and test real-world applications in c, simulating industry scenarios and preparing for technical roles in software development and problem-solving	SDG 8	Decent Work and Economic Growth	Equips students with industry-oriented programming skills, practical software development experience, and problem-solving abilities that enhance employability and career readiness

PRACTICUM-2			
Class: B.Tech. II-Semester		**Branch:** Common to all branches	
Course Code:	**U24EL209**	**Credits:**	**1**
Hours/Week (L-T-P-O-E):	**0-0-0-4-4**	**CIE Marks :**	**100%**
Total Number of Teaching Hours:	**-**	**ESE Marks :**	**-**

Course Learning Outcomes (COs):

After completion of this course, the students should be able to…

CO1: synthesize literature survey, identify research gaps and define objective & scope of practicum problem

CO2: apply knowledge to design & conduct experiments, utilize modern tools for solution of practicum problem and develop working model/ process/ system

CO3: demonstrate the generic competencies in making a well-documented report portraying knowledge, skills, qualities acquired through practicum

CO4: create a video pitch on practicum and make an effective oral presentation using PPTs

Practicum is an independent project carried out by the student during the course period, under the supervision of allotted course faculty. It helps to reinforce the students' theoretical knowledge and develop their ability to apply this knowledge to the solution of practical problems. Practicums also prepare them for their MINI and MAJOR PROJECTs and for independent work in their chosen field that promotes creative abilities. Besides they provide Higher Order Cognitive Abilities (HOCAs).

(i). Practicum is a mandatory semester project work.

(ii). Practicum is offered as a one credit course. Student has to earn 4 credits (one in each semester from I to IV semesters)

(iii). Allotment of Practicum topics for students:

- **Practicum matrix:** In week (-1), the class teacher, in consultation with HoD, shall prepare the practicum matrix of the section. The practicum matrix is the allotment of group of students to the different course faculty of the section, as shown below.

Course	**U24MH201**	**U24PY202**	**U24IN203**	**U24IN204**	**U24IN205**
Students allotted to different courses	B24XX001	B24XX011	B24XX021	B24XX031	B24XX041
	B24XX002	B24XX012	B24XX022	B24XX032	B24XX042
	B24XX003	B24XX013	B24XX023	B24XX033	B24XX043
	B24XX004	B24XX014	B24XX024	B24XX034	B24XX044
	B24XX005	B24XX015	B24XX025	B24XX035	B24XX045
	B24XX006	B24XX016	B24XX026	B24XX036	B24XX046

B24XX007	B24XX017	B24XX027	B24XX037	B24XX047
B24XX008	B24XX018	B24XX028	B24XX038	B24XX048
B24XX009	B24XX019	B24XX029	B24XX039	B24XX049
B24XX010	B24XX020	B24XX030	B24XX040	B24XX050

- In week (-1), the class teacher of a section shall collect 10-12 topics for practicum from each of the course teachers of that section.
- The class teacher, in consultation with HoD shall allot the practicum topics to the students of that section in the following format.

****

CIRCULAR

Allotment of Practicum topics to students

Section : …….

S.No.	Roll number of the student	Practicum topic allotted	Practicum under the course	Course faculty

Note:

1. The students should meet immediately the allotted course faculty for practicum and start working on the practicum with the guidance of course faculty.
2. To complete the Practicum, the student shall work in laboratories under supervision of allotted course faculty, in the allotted hours in the classwork timetable and also outside the class work hours during weekdays.
3. The course faculty are advised to guide the allotted students for practicum during the semester course work.

(Signature of class teacher)

****

(iv). ***To complete the practicum, the student shall work in laboratories under supervision of allotted course faculty, in the allotted hours in the classwork timetable and outside the class work hours during weekdays.***

(v). There shall be only continuous Internal Evaluation (CIE) for practicum for a maximum of 100 marks.

(vi). The practicum course faculty shall evaluate & submit the final marks of the allotted students in week (N+1) to the respective class teacher.

(vii). The class teacher shall collect the final marks of practicum of the students allotted to each

course teacher and submit them to the CoE.

(viii). Course faculty shall follow his/her own rubrics for practicum evaluation. Focus shall be on knowledge, skills & qualities acquired by the student during the practicum course

(ix). A sample rubrics for assessment and evaluation of practicum is as follows:

Literature survey & Identification of research gaps	10 marks
Working model / process / software package / system developed	30 marks
Report writing (subjected to max of 30% plagiarism)	20 marks
Oral presentation with PPT and viva-voce	20 marks
Video pitch	20 marks
Total	100 marks

Note: It is mandatory for the student to appear for oral presentation and viva-voce to qualify for course evaluation of Practicum.

(a) **Practicum Topic**: Each student shall be allotted a topic for practicum by the course faculty member attached to him/her. Interested students can work on their own title for practicum, but with due approval from course faculty.

(b) **Working Model**: Each student is required to develop a prototype / process / system/simulation model on the given practicum topic and demonstrate/present, during the allotted time, before the course teacher.

(c) **Report:** Each student is required to submit a well-documented report on the allotted practicum topic as per the format specified by the course faculty. The student shall include answers to the following questions in the report and ppt presentation.

- What was the objective of the practicum assigned?
- What are the main responsibilities and tasks for practicum?
- What knowledge and skills from the coursework are applied in the practicum?
- What new knowledge and skills are acquired during the practicum?
- In what ways, can the practicum be helpful for the professional career?
- What gaps are identified in your practicum work?
- What improvements or changes you suggest for addressing the identified gaps for future work?

(d) **Anti-Plagiarism Check:** The practicum report should clear plagiarism check as per the Anti-Plagiarism policy of the institute

(e) **Presentation:** Each student should prepare PPT with informative slides and make an effective oral presentation before the course teacheras per the schedule notified by the department

(f) **Video Pitch:** Each student should create a pitch video, which is a video presentation on his / her Practicum. Video pitch should be no longer than 5 minutes by keeping

the pitch concise and to the point, which shall also include evidence like videos & pics at the time of implementing the practicum and also key points about his / her business idea / plan (*if any*) and social impact

(g) The student has to register for the Practicum as a supplementary examination in the following cases:

i) he/she is absent for oral presentation and viva-voce

ii) he/she fails to submit the report in prescribed format

iii) he/she fails to fulfill the requirements of Practicum evaluation as per specified guidelines

CO–SDG Alignment Matrix				
CO	**CO Statement (The student should be able to…)**	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	synthesize literature survey, identify research gaps, and define the objective and scope of the practicum problem	SDG 4	Quality Education	Develops research aptitude, critical thinking, and problem identification skills through literature review and objective formulation
CO2	apply knowledge to design and conduct experiments, utilize modern tools for solving the practicum problem, and develop a working model/process/system	SDG 9	Industry, Innovation and Infrastructure	Promotes innovation, engineering design, experimentation, and the use of modern technologies to develop practical solutions
CO3	demonstrate the generic competencies in making a well-documented report portraying the knowledge, skills, and qualities acquired through practicum	SDG 4	Quality Education	Enhances technical documentation, analytical writing, and reflective learning skills essential for professional practice and lifelong learning
CO4	create a video pitch on the practicum and make an effective oral presentation using ppts	SDG 4	Quality Education	Strengthens communication, presentation, digital literacy, and professional dissemination skills for effectively presenting technical work

SOCIAL EMPOWERMENT ACTIVITY / SELF ACCOMPLISHMENT ACTIVITY			
Class: B.Tech.II Semester	**Branch:** Common to all branches		
Course Code:	**U24VA210XX**	**Credits:**	**1**
Hours/Week (L-T-P-O-E):	**0-0-0-2-2**	**CIE:**	**100%**
Total Number of Teaching Hours:	**-**	**ESE :**	**-**

Course Learning Outcomes (COs):

After completion of this course, the students should be able to…

CO1: integrate the five dimensions of physical, emotional, cognitive, spiritual and social aspects in life for holistic development and demonstrate social sensibility

CO2: interact effectively through written, oral and nonverbal communication with external-world in a professional, sensitive and culturally relevant manner

CO3: analyse the issues related to social empowerment / self-accomplishment, demonstrate problem-solving skills, articulate solutions and demonstrate social sensibility

CO4: demonstrate the generic competencies in making a well-documented report and an effective oral presentation with PPTs portraying knowledge, skills, qualities acquired through fieldwork/practice sessions and social impact of the course learning

Activity Based Liberal Learning about Life, Literature and Culture (ABLL@LLC) is introduced for building generic competencies in students. ABLL is aimed at all dimensional holistic growth of the learner. The holistic development includes the physical, emotional, cognitive, spiritual and social aspects. This is an area which opens the decision-making process, helps the student to develop creativity, an analytical mind, and builds resilience, confidence, hope, well-being and success. This will help student face the world with a greater degree of maturity, stoic and become a wholesome person in the society.

It is more than just learning from books to lead a successful life. These activity-based liberal learning courses, which help students to expand their social roles later in life, are offered under two sequels namely **SEA** (Social Empowerment Activities) and **SAA** (Self Accomplishment Activities)

These SEA/SAA courses also focus on building positive mindset: adopting optimism, acceptance, resilience, gratitude, mindfulness, and integrity in your life will help student develop and maintain a positive mindset.

(a) Each SEA/SAA activity is treated as one credit course

(b) Student must select one activity per semester, through first 04 semesters, from the courses listed under SEA/ SAA, before commencement of the semester.

(c) Students are required to earn minimum 04 credits under SEA/SAA, by completing minimum 02 credits through SEA and minimum 02 credits through SAA

(d) To complete these activities student shall work outside the class work hours, during weekends, holidays, semester breaks, etc.,

(e) If a student is not able to attend/ fulfil performance requirements, he/she shall be dropped from the course and shall have to enrol in the forthcoming semesters.

Monitoring SEA/SAA:

(a) **Nodal units:** The Student Activity Centre (SAC) and Centre for Innovation Incubation Research and Entrepreneurship (C-i²RE) shall act as nodal units for activities listed under SEA/SAA.

(b) During the semester period, the student has to **acquire requisite knowledge**, **conduct fieldwork**, acquire skills and propose unique solutions to the real-life problems

(c) **Knowledge Acquisition & Skilling**:

i. Students have to identify goals, acquire and accumulate knowledge on the chosen SEA/SAA activity
ii. For the activities related to social awareness/issues/challenges that affect society, use the knowledge base, apply relevant skills to analyse the issue and propose unique possible solutions to the social issues/challenges. Practice to acquire necessary skills to seek new opportunities in their personal and professional life.
iii. For the activities related to physical fitness, music, dance, fine arts, etc., guided practice sessions under supervision of expert/guru are to be planned and executed to acquire the benchmark skills to be demonstrated.

(d) **Fieldwork:** Fieldwork is an essential component of learning for gaining real-life experiences. In addition to knowledge acquisition & skilling, student has to take up fieldwork on the chosen activity, as part of SEA/SAA course.

i. This student-driven Fieldwork allow students to interact with the 'real world'. It is an autonomous learning (self-learning) situation that students are more actively involved during the activity and develop a deeper understanding and develop a more positive attitude.
ii. Fieldwork consists of three phases: preparation, the actual activity and feedback
iii. As part of fieldwork, student has to interact with at least two eminent personalities/achievers/renowned persons/inspiring and great personalities related to the activity chosen.
iv. Fieldwork will benefit students for any careers where they need to work with communities of people or which involves analysis of complex processes, especially social and cultural.
v. Certain skills are required for effective fieldwork, which include observation, communication, interviewing, problem solving, documentation, and more
vi. Other skills important for fieldwork practice include the ability to act in a crisis, to plan, set priorities, mobilize resources, and implement the plan effectively. These skills used in an integrated manner help students solve their problems and to develop one's own leadership style based on the need and culture of the place.
vii. **Eminent personalities/achievers/renowned persons/inspiring and great personalities**

Eminent personalities/ Achievers / Renowned personalities:

(a). **In case of socially relevant problems/ activities of SEA/SAA: E**minent personalities/ achievers include district administrative officers, Eminent Social workers / NGOs, other inspiring and great personalities

(b). **In case of Sports / Games and Cultural activities of SEA/SAA:** Eminent coaches/ trainers/gurus, achievers who represented/won state level/national level /international level competitions, other inspiring and great personalities.

viii. **For appointment to interact eminent personalities**: Student is expected to follow email etiquette rules and other appropriate polite communication etiquettes for getting appointment and time for interaction
ix. On fieldwork, student is expected to demonstrate solid time management, organisational and note taking skills during fieldwork
x. **Ethics of fieldwork**: Fieldwork is an educational process with commitment to positive values. All fieldwork should be planned and conducted in a way that is ethical, responsible and safe, for people, students, visited communities, if any,

and all other stakeholders. Student is expected to maintain integrity and honesty. Avoid bias and deception. Protect the rights and well-being of people involved in fieldwork. The privacy, confidentiality and respect for the eminent people interacted should be maintained and their time, inputs & guidance are to be acknowledged

xi. Student is expected to take care of health and Safety practices for fieldwork and travel

xii. Student should remember that contrary to a *field trip or company visit*, **the emphasis in fieldwork is on acquiring skills**, and not on casually presenting theory and assessing.

xiii. For the fieldwork, student shall go with a scientifically designed questionnaire and record the responses during interaction. These response sheets, along with geo-tagged pic of fieldwork (at the time of interaction & practise sessions, if any) shall be appended as annexures in the report to be submitted for course evaluation.

xiv. **Feedback:** The learnings the student made out of interaction with eminent achievers shall be presented in the report as one of the chapters.

- During feedback, the central focus is on the elaboration of the students' experience during fieldwork. Therefore, the student should create an end product, such as a demonstration/presentation and report in which they demonstrate a link between their experiences during fieldwork and the underlying theoretical concepts and ideas.

(e) **Demonstration / Presentation and Report**: Student after presentation/demonstration of his/her achievements/work, shall get a certificate from the concerned nodal unit and submit a report, in the prescribed format, to the faculty counsellor for award of grade.

(f) **Flow process for completion of SEA/SAA course**:

i. ***Faculty counsellor approval***: In week (-1), in consultation with faculty counsellor, every student shall, identifies minimum of 4 activities listed under SEA/SAA activities, lists their priority and fills the same in ONLINE REGISTRATION FORM FOR SEA/SAA (received in their domain mail id) to Dean, Student Affairs. Dean, Student Affairs shall release the section wise allotment of SEA/SAA courses to students along with the details of supervising faculty of nodal centre. The allotment details shall be shared to the SEA/SAA coordinator and the student through domain mail id of the student

ii. ***Identification of goals and preparation of action plan:*** In week (1), the respective faculty coordinator(s) of nodal centres shall address the students allotted to them to educate them on fixing goals, plan of action for completion and evaluation. In consultation with nodal centre, based on the workflow of the allotted activity, every student shall identify the goals (of activity) & eminent personalities (to be visited during the field trip) and prepare action plan (oriented workflow) for attaining the identified goals.

iii. ***Field work:*** Under the guidance of nodal centre, student shall complete the field work, based on the action plan, with the progress continuously monitored by the faculty counsellor and the nodal centre.

iv. ***Demonstration/ Presentation:*** After completion of field work, student shall demonstrate/present his achievements (knowledge/skills gained during the activity) at the nodal centre in the presence of external experts/senior practitioners of the activity. After successful demonstration/presentation, the

nodal centre shall provide a certificate of completion indicating that the student has completed the activity in the stipulated time.

v. ***Report writing:*** After successful demonstration/presentation, student shall write a 2–3-page report and submit the same to the faculty counsellor. The report shall emphasize knowledge, skills and qualities acquired through the SEA/SAA activities. It shall also include the influence of these activities on enhancing confidence, positive change in life, decision making, transforming choices into desired actions/outcomes.

(g) ***Assessment & Evaluation:*** There shall be *only Continuous Internal Evaluation (CIE) for SEA/SAA*. The SEA/SAA activities shall be evaluated at the end of the semester through respective evaluation processes, which shall include field work, presentation/ demonstration, submission of reports on the gathered data/information/ surveys, the details of which have been shown in below table. The department level SEA/SAA coordinator shall collect marks from the nodal centres and faculty counsellors, consolidate them, and submit the final grades to the examination branch, within one week of the last day of instruction. Evaluation of SEA/SAA activities shall be completed as and when students are ready, but not later than week (N+1).

The CIE for SEA/SAA is as follows:

Assessment	**Maximum marks**	**Marks to be awarded by**
Goal setting, Planning & Knowledge Acquisition	20	Nodal centre
Field work	40	Nodal centre
Demonstration/Presentation	20	Nodal centre
Report submission	20	Faculty counsellor
Total	**100**	**-**

Note:

(a) **Presentation/ Demonstration:** It is mandatory for the student to appear for demonstration and (or) oral presentation oral presentation to qualify for course evaluation. In case of presentation, student should prepare PPT with informative slides including the geo tagged photos of his/her field trips/interactions as per the schedule notified by the nodal centre. In case of demonstration, student must take timeslot from the nodal centre and demonstrate the skills learnt/improved during the allotted timeslot.

- The necessary arrangements for demonstration shall be looked after the student in consultation with the coordinator with due permission from Head of the department.

(b) **Report:** Each student is required to submit a well-documented report on the chosen SEA/SAA topic as per the format specified by *department level SEA/SAA coordinator.*

(c) **Anti-Plagiarism Check:** The SEA/SAA report should clear plagiarism check as per the Anti-Plagiarism policy of the institute.

(d) **Requirements for passing the course:** A student is deemed to have passed SEA/SAA if he/she

a. successfully demonstrates/presents the skills attained at the end of course as per the schedule notified by the nodal centre, **and**
b. scores a minimum of 40 marks in the CIE of the course

(e) **Supplementary examination:** If a student fails in SEA/SAA activity of a particular semester, he must complete the same by enrolling it in the next higher semesters.

Text / Reference book(s):

For knowledge acquisition, students shall refer to textbooks and web resources relevant to the course selected. Plan for fieldwork/practice sessions in coordination with SEA/SAA coordinator

CO–SDG Alignment Matrix				
CO	**CO Statement (The student should be able to…)**	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	integrate the five dimensions of physical, emotional, cognitive, spiritual and social aspects in life for holistic development and demonstrate social sensibility	SDG 3	Good Health and Well-being	Promotes holistic well-being, emotional resilience, and social responsibility for personal and community development
CO2	interact effectively through written, oral and nonverbal communication with the external world in a professional, sensitive and culturally relevant manner	SDG 4	Quality Education	Enhances communication, interpersonal, and professional skills essential for lifelong learning and career success
CO3	analyse issues related to social empowerment and self-accomplishment, demonstrate problem-solving skills, articulate solutions, and demonstrate social sensibility	SDG 10	Reduced Inequalities	Encourages social inclusion, equity, empowerment, and responsible problem-solving to address societal challenges
CO4	demonstrate the generic competencies in making a well-documented report and an effective oral presentation with ppts portraying knowledge, skills, qualities acquired through fieldwork/practice sessions and the social impact of course learning	SDG 4	Quality Education	Develops documentation, presentation, reflective learning, and communication skills through experiential learning and community engagement

EXPERT TALK SERIES-II			
Class: B.Tech. II -Semester	**Branch:** Common to all branches		
Course Code:	**U24AE211**	**Credits:**	**1**
Hours/Week (L-T-P-O-E):	**0-0-0-1-1**	**CIE Marks :**	**100%**
Total Number of Teaching Hours:	**-**	**ESE Marks :**	**-**

Course Learning Outcomes (COs):

After completion of this course, the students should be able to…

CO1: identify real-world problems, different career paths, industry requirements, emerging job roles, business practices and exploit new opportunities by staying up-to-date with industry knowledge, trends and technology

CO2: identify what 21st century employability-related skills and professional etiquette are must in a range of recruitment situations, what skills are absent in him/her, and demonstrate skill improvement

CO3: interact with experts, exhibit confidence, demonstrate improved communication and networking abilities potentially leading to mentorship opportunities, internships, or even future job prospects

CO4: demonstrate the generic competencies in making a well-documented report portraying knowledge, skills, qualities acquired through ETS sessions and impact of the expert talks

In the 21st century, for successful career, degree alone won't suffice. Competencies are much more important.

(a) You need to be aware of the real-world problems, industry working style, need to be confident and smart and you also need to know the tricks of the trade.

(b) Learning from industry experts with real-world examples, is important to enhance your educational experience.

(c) Enhanced graduate employability benefits all stakeholders. To effectively enhance employability and the immediacy of adding value to company/project, it is important that you are aware of what you are learning and its use in the workplace. The cognitive abilities viz., remember, understand, recall, and application of knowledge and other skills acquired in higher education can be maximised if you are clear on the purpose of your developed competencies and how to apply them in a range of complex situations.

(d) Graduate employability could be enhanced through fostering lifelong learning, the development of a range of employability-related competencies and increased confidence and capacity in "reflecting on and articulating these capabilities and attributes in a range of recruitment situations".

But how would you know all this without venturing into the industry?

(e) The answer is Industry **Expert Talk Series (ETS)**. Through ETS, we invite industry experts in different fields to deliver talks and interact with students.

(f) Through Industry expert talks students get to know so much more that textbooks don't explain.

(g) Students have the opportunity to learn from professionals who have achieved

success in their respective fields. These speakers often share their personal experiences, case studies, and anecdotes, providing students with real-world examples and perspectives that go beyond theoretical concepts.

(h) Our competency-focussed curriculum URR24 is designed to contribute greatly to the nurturing and development of each of these facets among students through ETS courses

(i) ETS helps students gain improved industry engagement for an easier transition into the workplace, broader career progression opportunities and personal development.

(j) In URR24 curriculum, Expert talk series (ETS) is offered as a course under **ability enhancement category of courses**.

(k) Through ETS sessions, students get the chance to interact with industry regularly which helps them focus on the needs and requirements of current industry. This will not only enthuse the students with new ideas but also motivate them to understand what kind of 21st century skills are needed in industry and how they need to groom themselves.

(l) Through ETS sessions, another benefit is that students learn the importance of soft skills like communication, presentation, email etiquettes, corporate grooming and dressing styles. Conversing with successful people is the biggest motivation and students gain in more ways than one through ETS sessions.

(m) ETS enhances your learning in many ways for global opportunities for your career.

(n) All in all, learning from industry experts**,** is a wonderful opportunity for student to getting acquainted with professional etiquette, acquiring professional knowledge, and getting to know the internal workings of an organization.

(o) Salient features of ETS are hereunder:

(i) ETS is offered from I semester to VI semester.

(ii) ETS, in any given semester, is treated as one credit course

(iii) Students are required to earn six credits (from I to VI semester)

(iv) **Head, Centre for i²RE** shall be the **institute level ETS coordinator**

(v) Under this course, a minimum of 10 expert talks shall be organized in **online/offline mode** by the parent department / Centre for i²RE.

(vi) Each expert talk shall be for a minimum duration of 45 minutes (*but not exceeding 90 minutes*) followed by **online quiz/test** for 10 marks (10 MCQs/FiBs , *duration: 10-15 mins*), on the contents covered in the expert talk.

(vii) **The Head C-i²RE** shall share the marks obtained by the students in each of the quizzes / tests to the respective **department ETS coordinators.**

(viii) Each student shall attend a minimum of 6 expert talks and attempt the corresponding quizzes/ tests conducted at the end of the talks.

(ix) **Report on ETS:** At the end of semester, the student shall submit a well-documented report on the acquired knowledge and skills, in the prescribed format, to the department ETS coordinator.

(x) **Evaluation:** There shall be only continuous Internal Evaluation (CIE) for ETS for a maximum of 100 marks

(xi) The department ETS coordinator shall, in coordination with institute level ETS coordinator, submit the final scores to the CoE in week (N+1).

(p) The CIE for ETS is as follows:

Rubrics for evaluation of ETS

Quiz score (*sum of best 6 quiz scores out of 10 quizzes. Each quiz evaluated for 10 marks*)	60 marks
Attendance (*out of 10 quizzes*)	20 marks
Report in prescribed format (*max 30% plagiarism*)	20 marks
Total	100 marks

i. **Attendance**: Maximum of 20 marks shall be awarded based on the attendance maintained by the student over a maximum of 10 lectures.

$$Marks\ for\ attendance = \frac{Number\ of\ expert\ talks\ attended\ fully}{10} * 20$$

ii. Supplementary Exam:

(a) Student has to register for ETS supplementary examination if he/she scores less than 40 marks in CIE

(b) The ETS supplementary examination shall be conducted by the parent department, in physical mode, for 100 marks (MCQs/FiBs , *duration: 2Hrs*) on the content covered in ETS lectures.

(c) Department ETS coordinator shall, in coordination with the institute level ETS coordinator, conduct the supplementary exam, and submit scores to the CoE

(d) Exam material/resources for supplementary: Recorded videos of ETS arranged for that semester, which shall be made available on ETS webpage of institute website

CO–SDG Alignment Matrix				
CO	**CO Statement (The student should be able to…)**	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	identify real-world problems, different career paths, industry requirements, emerging job roles, business practices, and exploit new opportunities by staying up-to-date with industry knowledge, trends, and technology	SDG 8	Decent Work and Economic Growth	Equips students with industry awareness, career readiness, and entrepreneurial thinking to enhance employability and contribute to sustainable economic growth
CO2	identify essential 21st-century employability skills and professional etiquette, recognize skill gaps, and demonstrate continuous skill improvement	SDG 4	Quality Education	Promotes lifelong learning, professional development, and acquisition of employability skills required for higher education and the workplace
CO3	interact with experts, exhibit confidence, and demonstrate improved communication and networking abilities leading to mentorship, internships, and future job opportunities	SDG 8	Decent Work and Economic Growth	Strengthens professional communication, networking, and industry engagement, improving career opportunities and workplace readiness
CO4	demonstrate generic competencies by preparing a well-documented report portraying the knowledge, skills, qualities acquired through ets sessions, and the impact of expert talks	SDG 4	Quality Education	Encourages reflective learning, effective communication, documentation skills, and continuous professional development

ARDUINO PROGRAMMING			
Class: B.Tech. Syllabi of exit course for UG certificate in CSE(IOT)		**Branch:** CSE (IOT)	
Course Code:	**U26IN212X**	**Credits:**	**3**
Hours/Week (L-T-P-O-E):	**2-0-2-0-4**	**CIE Marks (%):**	**60**
Total Number of Teaching Hours:	**32 Hrs**	**ESE Marks (%):**	**40**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1: identify sensors, actuators and IoT boards in real time environment
CO2: make use of syntax of i/o functions for problem solving
CO3: compare analog, and digital communications with Arduino
CO4: design a real time application using sensors, actuators and Arduino board
CO5: develop arduino programming for problem solving
CO6: develop arduino programming with LED, button and switch
CO7: interpret analog and digital communications with arduino
CO8: develop arduino programming for connecting sensors and actuators to control the applications

THEORY COMPONENT

UNIT-I	**4 Hrs**

Introduction: Introduction to IoT, Evolution of IoT, challenges and applications, IoT versus M2M and IoT versus CPS, Sensors: characteristics, Deviations, Types-scalar, Multimedia, Hybrid and virtual, Actuators: Types-Hydraulic, Pneumatics, Electric, Thermal or Magnetic, Mechanical

Classification of IoT boards: Microcontroller boards, Single board controller, System on chipboard

UNIT-II	**4 Hrs**

Programming with Arduino: Introduction to Arduino, String objects; Time, I/O function, Display, Random numbers, GPIO, Controlling LEDs-Blinking led without delay, Connecting an external led, Working with buttons-Connecting a button, Button with no resistor

UNIT-III	**4 Hrs**

Analog and Digital Communication with Arduino: Interfacing LCD character display, UART protocol

I2C Communication: I2C protocol, SPI Communication: SPI protocol, SD card interfacing

UNIT-IV	**4 Hrs**

Integration of Sensors with Arduino: Interfacing with potentiometer, Temperature sensor, Detecting motion using PIR sensor, Measuring distance using infrared and ultrasonic sensor

Integration of Actuators with Arduino: DC motor, Servo motor, Stepper motor

LABORATORY COMPONENT

List of Experiments

1. Introduction of Arduino IDE, write an Arduino program to demonstrate all the statements and functions
2. Write an Arduino program to demonstrate if statements, switch case, loops and arrays
3. Write an Arduino program to demonstrate string object, time based functions, digital and analog I/O functions.
4. Write an Arduino program to demonstrate light an LED with button and 7-segement display

5. Write an Arduino program to demonstrate I2C and SPI communication protocol
6. Write an Arduino program for interfacing with potentiometer and temperature sensor
7. Write an Arduino program for interfacing with PIR sensor and infrared and ultrasonic sensor
8. Write an Arduino program for interfacing with DC motor

Textbook(s):

1. Sudeep Mishra, Anandarup mukherjee and Arijit Roy, *Introduction to IoT*, New Delhi: University Cambridge Press, 2021. (Chapter 4)
2. Cornel Amariei, *Arduino Development Cook Book*, Birmingham: Packt Publishing Ltd., 2015. (Chapter 2-6)

Reference Book(s):

1. Arshdeep Bahga and Vijay Madisetti, *Internet of Things: A Hands-On Approach,* Hyderabad: University Press, 2015.
2. Marco Schwartz, *Internet of Things with ESP8266*, Birmingham: Packt Publishing Ltd., 2016.
3. Rajesh Singh, Anita Gehlot, Lovi Raj Gupta, Bhupendra Singh, Mahendra Swain, *Internet of things With Raspberry Pi and Arduino*, Boca Raton: CRC Press, Taylor & Francis Group,2020.
4. Brian Evans, *Beginning Arduino Programming*, New York: Apress, 2011.

Web and Video link(s):

https://onlinecourses.nptel.ac.in/noc24_cs115/*; NPTEL Video Lecture on Fundamentals of Internet of Things by Prof. Sudip Misra, Professor of CSE, IIT Kharagpur.*

Laboratory Manual (for laboratory component):

Fundamentals of Internet of Things laboratory manual, Department of CSE(N), KITSW

Course Articulation Matrix (CAM):		**U24IN212X: ARDUINO PROGRAMMING**												
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	**U24IN212X.1**	2	2	2	2	2	1	1	1	-	1	-	2	2
CO2	**U24IN212X.2**	2	2	2	2	2	1	1	1	-	1	-	2	2
CO3	**U24IN212X.3**	2	2	2	2	2	1	1	1	-	1	-	2	2
CO4	**U24IN212X.4**	2	2	2	2	2	1	1	1	-	1	-	2	3
CO5	**U24IN212X.5**	2	2	2	2	2	1	1	1	-	1	-	1	2
CO6	**U24IN212X.6**	2	2	2	2	2	1	1	1	-	1	-	1	2
CO7	**U24IN212X.7**	2	2	2	2	2	1	1	1	-	1	-	2	2
CO8	**U24IN212X.8**	2	2	2	2	2	1	1	1	-	1	-	2	2
U26IN212		**2**	**2**	**1**	**1**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**

CO–SDG ALIGNMENT MATRIX				
CO	**CO STATEMENT (THE STUDENT SHOULD BE ABLE TO…)**	**RELEVANT SDG**	**SDG DESCRIPTION**	**MAPPING JUSTIFICATION**
CO1	identify sensors, actuators and iot boards in a real-time environment	SDG 4	Quality Education	Develops fundamental knowledge of IoT hardware, embedded systems, and real-time applications through experiential learning
CO2	make use of syntax of i/o functions for problem solving	SDG 4	Quality Education	Enhances programming and computational thinking skills through practical implementation of embedded programming concepts
CO3	compare analog and digital communications with arduino	SDG 9	Industry, Innovation and Infrastructure	Builds knowledge of communication techniques used in embedded systems and IoT-based industrial applications
CO4	design a real-time application using sensors, actuators and arduino board	SDG 11	Sustainable Cities and Communities	Enables the development of smart IoT applications for automation, environmental monitoring, and sustainable community solutions
CO5	develop arduino programming for problem solving	SDG 4	Quality Education	Strengthens practical programming and problem-solving skills through hands-on Arduino application development
CO6	develop arduino programming with led, button and switch	SDG 9	Industry, Innovation and Infrastructure	Provides practical experience in embedded hardware interfacing and automation system development
CO7	interpret analog and digital communications with arduino	SDG 9	Industry, Innovation and Infrastructure	Enhances the ability to analyze communication methods used in embedded and IoT systems for reliable data exchange
CO8	develop arduino programming for connecting sensors and actuators to control applications	SDG 11	Sustainable Cities and Communities	Facilitates the design and implementation of smart control systems that support sustainable automation and IoT-enabled infrastructure

WEB DEVELOPMENT			
Class: B.Tech. Syllabi of exit course for UG certificate in CSE(IOT)		**Branch:** CSE (IOT)	
Course Code:	**U24IN213X**	**Credits:**	**3**
Hours/Week (L-T-P-O-E):	**2-0-2-0-4**	**CIE Marks (%):**	**60**
Total Number of Teaching Hours:	**32 Hrs**	**ESE Marks (%):**	**40**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1: create static web pages using HTML Tags, CSS properties and Java scripts.
CO2: *:* create dynamic web pages using java server page concepts.
CO3: develop web server side applications using PHP concepts.
CO4: develop enterprise databases for web-based applications using PHP and MySQL.
CO5 : build static webpages using HTML Tags, CSS properties and Javascripts
CO6 : build dynamic web pages using JSP concepts.
CO7 : develop server side scripts for web applications using PHP.
CO8 : develop databases for web-based applications using PHP and MySQL, XML.

THEORY COMPONENT

UNIT-I	4 Hrs

HTML WITH CSS: Document Structure, Basic Tags, Working with Images, Tables, Frames, Forms, CSS (Cascading style sheet) rules and properties, Types: Inline, External and Internal Style Sheets.

JAVASCRIPT: JavaScript syntax, Embedding JavaScript in HTML Page. Usage of variables, Working with Operators, Control-Flow Statements, Functions and Array, Creating Objects, Handling Events.

UNIT-II	4 Hrs

JSP: Syntax and Semantics, JSP Development Model, Components of JSP page: Directives, Comments, Expressions, Scriptlets, Declarations, Implicit Objects, Standard Actions, Tag Extensions, A Complete JSP Example. Session and Thread Management: Session Tracking, Session API, Thread Management. Application Event Listeners.

JDBC: Database access with JDBC, Overview, JDBC drivers, connecting to database with Driver Manager, Statement Interfaces: Statement, Prepared statement, Callable statement, Result Sets.

UNIT-III	4 Hrs

Introduction to PHP: Overview of PHP, Advantages of PHP over scripting languages, Creating and running a PHP script, handling errors. Controlling Program Flow: Conditional Statements, Looping Statements. Working with Functions, Arrays, Files and Directories.

Working with Forms: Web Forms and Form Elements, Processing a Web Form, Validating a Web Form.

UNIT-IV	4 Hrs

Database using PHP: Exploring Relational Database Model, Records and Primary Keys. Working with SQL Statements. Using PHP and MySql: Checking Configuration, Connecting to Database, Selecting a Database, Adding and Altering a Table in a Database, Inserting and modifying Data in a Table, Retrieving Data from a Table.

XML: Introduction to XML, XML Basics: Syntax, Declaration, Valid XML Documents, Viewing XML, XML Technologies, Document Object Model(DOM).

LABORATORY COMPONENT

List of Experiments

1.Design the following static web pages with the following attributes:

a) Basic Tags.
b) Heading Tags.
c) List (Ordered and Un-Ordered).
d) Textbox, Buttons.

2. Design a CATALOGUE PAGE:

The catalogue page should contain the details of all the books available in the web site in a table. The details should contain the following:

- Snapshot of Cover Page.
- Author Name and Publisher.
- Price and Add to cart button.

Logo	WebsiteName			
Home	Login	Registration	Catalogue	Cart
CSE ECE EEE CIV		Book: Web Technologies Author: Kogent Publication:DreamtechPress	$50	Add to Cart
		Book:JSPCompleteReference Author: Phil Hanna Publication: McGraw Hill	$28.5	
		Book: Web Technologies Author: Uttam K. Roy Publication:Oxford HigherEd	$40	Add to Cart Add to Cart

2. Write a program to embed Java Script in HTML pages.
3. Write a HTML file to create a simple form with 5 input fields (Name, Password, Email, Pin code, Phone No. and a Submit button) and demonstrate required field validations to validate that all input fields are required and display error messages if the above validations do not hold using JSP
4. Create Database Connectivity with JSP page with different JDBC Drivers.
5. Create a CRUD operation for JSP Page using MySQL.
6. Write a PHP which does the following job:
   Insert the details of the 3 or 4 users who register with the web site by using student registration form (experiment-32) authenticate the user when he submits the login form using the UserName and Password from the database(instead of cookies).
7. Create tables in the database which contain the details of items (books in our case like Bookname, Price, Quantity,Amount) of each category. Modify your catalogue page in such a way that you should connect to

the database and extract data from the tables and display them in the catalogue page using PHP.

8. Design a form which upload & display image using PHP.

Textbook(s):

1. Kogent, *Web Technologies* 1st ed., Dream tech Press (Black Book), 2013.
2. Phil Hanna, *JSP: The Complete Reference*, 2nd ed., McGraw-Hill, 2001.

Reference Book(s):

1. Ivan Bayross, *Web Enabled Commercial Application Development Using HTML, JavaScript, DHTML and PHP*, 4th ed., BPB Publications, 2009.
2. Uttam K. Roy, *Web Technologies*, 7th ed., Oxford Higher Education, 2010.
3. Luke Welling, Laura Thomson, *PHP and MySQL Web Development*, 3rd ed., Sams Publications, 2005.
4. Jayson Falkner, Kevin Jones, *Servlets and Java Server Pages*, 1st ed., Pearson, 2003.

Web and Video link(s):

https://youtu.be/YOXwcbwSEUo?si=YHrGYJTYkphU7t5j NPTEL Video Lecture on WEB PROGRAMMING by Prof.I.Sengupta, Department of Computer Science & Engineering ,IIT Kharagpur..

Laboratory Manual (for laboratory component):

Web Programming, laboratory manual, Department of CSN, KITSW

Course Articulation Matrix (CAM):		U24IN213X WEB DEVELOPMENT											
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24IN213X.1	2	2	2	1	2	1	-	1	2	1	2	1	2
CO2	U24IN213X.2	2	2	2	1	2	1	-	1	2	1	2	1	2
CO3	U24IN213X.3	2	2	2	1	2	1	-	1	2	1	2	1	2
CO4	U24IN213X.4	2	2	2	1	2	1	1	1	2	1	2	1	3
CO5	U24IN213X.5	2	2	2	1	1	-	-	1	2	1	-	2	2
CO6	U24IN213X.6	2	2	2	2	3	-	-	1	2	1	-	2	2
CO7	U24IN213X.7	2	2	2	2	3	-	-	1	2	1	-	2	2
CO8	U24IN213X.8	2	2	2	2	3	-	-	1	2	1	-	2	2
U24IN213X		**2**	**2**	**2**	**1.3**	**2.25**	**0.5**	**0.125**	**1**	**2**	**1**	**1**	**1.5**	**2**

CO–SDG ALIGNMENT MATRIX				
CO	**CO STATEMENT (THE STUDENT SHOULD BE ABLE TO…)**	**RELEVANT SDG**	**SDG DESCRIPTION**	**MAPPING JUSTIFICATION**
CO1	create static web pages using html tags, css properties and javascript	SDG 4	Quality Education	Develops fundamental web development skills and enhances students' ability to design user-friendly web interfaces
CO2	create dynamic web pages using java server pages (jsp) concepts	SDG 9	Industry, Innovation and Infrastructure	Builds expertise in dynamic web technologies required for developing scalable and interactive web applications
CO3	develop web server-side applications using php concepts	SDG 9	Industry, Innovation and Infrastructure	Enhances server-side programming skills for developing secure and efficient web-based software solutions
CO4	develop enterprise databases for web-based applications using php and mysql	SDG 9	Industry, Innovation and Infrastructure	Promotes database design and management skills essential for enterprise-level web applications and digital infrastructure
CO5	build static web pages using html tags, css properties and javascript	SDG 4	Quality Education	Strengthens practical skills in front-end web development through hands-on implementation
CO6	build dynamic web pages using jsp concepts	SDG 9	Industry, Innovation and Infrastructure	Provides practical experience in developing interactive and dynamic web applications using enterprise technologies
CO7	develop server-side scripts for web applications using php	SDG 9	Industry, Innovation and Infrastructure	Develops practical competencies in server-side scripting for robust and scalable web application development
CO8	develop databases for web-based applications using php, mysql and xml	SDG 9	Industry, Innovation and Infrastructure	Enhances practical skills in database integration and data management for enterprise web applications

RASPBERRY PI PROGRAMMING			
Class: B.Tech. Syllabi of exit course for UG certificate in CSE(IOT)		**Branch:** CSE()	
Course Code:	**U26IN214X**	**Credits:**	**3**
Hours/Week (L-T-P-O-E):	**2-0-2-0-4**	**CIE Marks (%):**	**60**
Total Number of Teaching Hours:	**32 Hrs**	**ESE Marks (%):**	**40**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1: *analyze instruction formats and addressing modes of assembly language*

CO2: *classify hardwired & CISC style processors and solve arithmetic operations using signed and unsigned integers*

CO3: *categorize cache memory mapping techniques and examine data transfer between processor, memory & I/O*

CO4: *analyze different modes of data transfer, classify interconnection structures and distinguish CPU vs. GPU architectures & computations*

CO5 : *develop python programs using operators, control statements & functions*

CO6 : *apply namespaces, packages, string handling methods of Python for writing programs*

CO7 : *implement architecture of raspberry pi using linux commands*

CO8 : *build python programs using pi to interface with sensors, actuators, led's, cloud, camera and display unit*

THEORY COMPONENT

UNIT-I	4 Hrs

Introduction: Writing and executing python programs with indentation

Python Preliminaries: Literal constants, Variables and identifiers, Data types, Input operation, Comments, Reserved words, Operators, Expressions in python, Type conversion

Decision Control Statements: Selection/conditional branching statements, Loop structures/ iterative statements, Nested loop, The continue statement, The else statement used with loops

Functions: Function definition, Function call, Variable scope and lifetime, The return statement, Decorator functions, Lambda functions, Recursive functions

UNIT-II	4 Hrs

Modules and Name Spaces: The from…import statement, Naming module, Packages in python, Standard library modules

Python Strings: String operations, String formatting operator, slice operation, Comparing strings

Data Structures: Arrays, Sequences, Lists, Tuple, Sets, Dictionaries

UNIT-III	4 Hrs

Raspberry Pi: Introduction, architecture, components of Pi, Peripherals, GPIO connectors, Accessories; Software- Pi operating system and software development tools, Installing OS and designing systems using Raspberry Pi, Introducing essential packages of python for Pi

Linux Commands: ls, cd, touch, mv, rm, man, mkdir, rmdir, tar, gzip, cat, more, less, ps, sudo, cron, chown, chgrp, ping and process related commands

UNIT-IV	4 Hrs

Raspberry with Python: Installing Pip and invoking python interpreter, Using object oriented code and controlling digital output's of LED's, Interface sensors and actuators with Raspberry Pi, Collecting sensor data and storing it on cloud

Image Processing with Pi: Interfacing camera with Pi, Interfacing display with Pi

LABORATORY COMPONENT

List of Experiments

1. Installation of Python, write a program to demonstrate importance of indentations. Purposefully raise Indentation Error and correct it.
2. Write a program to find circulating 'n' values and module using import statement.

3. Write python program on file operations for the following
   i.To open and read data from a file
   ii.To write data into a file
   iii.To compute number of characters, words, lines in a file
4. Installation of OS onto Raspberry Pi, Start Raspberry Pi and try various Linux commands in command terminal window:
   i. ls, cd, touch, mv, rm, man, mkdir, rmdir, tar, gzip
   ii. cat, more, less, ps ,sudo, cron, chown, chgrp, Ping,process-related commands etc.
5. Write a program to demonstrate LED with two buttons and light an LED through web.
6. Get input from DHT sensor, ultrasonic sensor, PIR sensor and upload on cloud.
7. Working with 7-segment display using Raspberry Pi
8. Interfacing Camera with Pi for image processing and design a program to demonstrate DC motor.

Textbook(s):

[1] ReemaThareja, *Python Programming using problem solving approach*, New Delhi: Oxford University Press, 2017.(*Chapter 1 to 7*)

[2] Matt Richardson,*Shawn Wallace,Getting Started with Raspberry Pi*, O'Reilly (SPD), 3rd ed., New Delhi:2016.(*Chapter 2 to 4*)

Reference Book(S):

[1] Dr.Charles, R. Severance, *Python for Everybody-Exploring Data Using Python*, New Delhi: open book, 2016.

[2] David Beazley, *Python Cookbook*, 3rd ed.California: O'Reilly Media, Inc., 2013.

[3] Caleb Hattingh, *20 Python Libraries You Aren't Using (But Should)*, 2nd ed.California: O'Reilly Media, Inc., 2016.

[4] Magnus Lie Hetland, *Beginning: from Novice to Professional*,New York City: Apress, 2005.

Web and Video link(s):

#nptel #pythonprogramming #skumaredu *NPTEL Video Lecture on PROGRAMMING IN PYTHON by* Dr. Rizwan Rehman , *Assistant Professor of* Dibrugarh University.

Laboratory Manual (for laboratory component):

1. *RASPBERRY PI PROGRAMMING Laboratory Manual*, Dept. of CSE (IoT), KITSW.

Course Articulation Matrix (CAM):		U26IN214X: RASPBERRY PI PROGRAMMING												
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	**U26IN214X.1**	2	2	1	1	2	1	-	1	1	1	-	1	2
CO2	**U26IN214X.2**	2	2	2	1	2	1	-	1	1	1	-	1	2
CO3	**U26IN214X.3**	2	2	2	2	3	1	-	1	1	1	-	1	2
CO4	**U26IN214X.4**	2	2	2	2	3	1	-	1	1	1	-	1	2
CO5	**U26IN214X.5**	2	2	2	2	2	1	-	1	1	1	-	1	2
CO6	**U26IN214X.6**	2	2	2	2	2	1	-	1	1	1	-	1	2
CO7	**U26IN214X.7**	2	2	2	2	3	1	-	1	1	1	-	1	2
CO8	**U24IN214X.8**	2	2	2	2	3	1	-	1	1	1	-	1	2
U24IN214X		**2**	**2**	**1.87**	**1.75**	**2.5**	**1**	**-**	**1**	**1**	**1**	**-**	**1**	**2**

CO–SDG ALIGNMENT MATRIX				
CO	**CO STATEMENT (THE STUDENT SHOULD BE ABLE TO…)**	**RELEVANT SDG**	**SDG DESCRIPTION**	**MAPPING JUSTIFICATION**
CO1	analyze instruction formats and addressing modes of assembly language	SDG 4	Quality Education	Develops foundational knowledge of computer organization and programming, strengthening analytical and technical skills
CO2	classify hardwired & cisc style processors and solve arithmetic operations using signed and unsigned integers	SDG 9	Industry, Innovation and Infrastructure	Enhances understanding of processor architectures and computational techniques essential for modern computing systems
CO3	categorize cache memory mapping techniques and examine data transfer between processor, memory and i/o.	SDG 9	Industry, Innovation and Infrastructure	Builds competency in efficient memory management and computer architecture for high-performance computing systems
CO4	analyze different modes of data transfer, classify interconnection structures and distinguish cpu vs. gpu architectures and computations	SDG 9	Industry, Innovation and Infrastructure	Promotes knowledge of advanced computing architectures and efficient system design for innovative technological applications
CO5	develop python programs using operators, control statements and function	SDG 4	Quality Education	Strengthens programming proficiency and problem-solving skills through practical software development
CO6	apply namespaces, packages and string handling methods of python for writing programs	SDG 4	Quality Education	Enhances software development skills by applying modular programming concepts and Python libraries
CO7	implement the architecture of raspberry pi using linux commands	SDG 9	Industry, Innovation and Infrastructure	Develops practical skills in embedded systems and Linux-based computing platforms for industrial applications
CO8	build python programs using raspberry pi to interface with sensors, actuators, leds, cloud, camera and display unit	SDG 11	Sustainable Cities and Communities	Enables the development of IoT-enabled smart applications for automation, monitoring, and sustainable infrastructure

III SEMESTER

S. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	C
1	PCC	U24IN301	Fundamentals of IoT	2	1	2	5	10	4
2	PCC	U24IN302	Operating Systems	2	1	-	4	7	3
3	PCC	U24IN303	Advanced Data Structures	2	1	2	5	10	4
4	PCC	U24IN304	Computer Networks	2	1	-	4	7	3
5	PCC	U24IN305	OOP through Java	2	1	2	5	10	4
6	VAC	U24VA306B	Soft and Interpersonal Skills	-	-	2	2	4	1
7	SEC	U24SE307	PSD Lab-02	-	-	2	2	4	1
8	ELC	U24EL308	Practicum-3	-	-	-	4	4	1
9	VAC	U24VA309XXXXX	SEA-3 / SAA -3	-	-	-	2	2	1
10	AEC	U24AE310	Expert Talk Series-3	-	-	-	1	1	1
			Total:	10	5	10	34	59	23
Summer/ Inter-semBridge Courses (Approved by BoS and Dean,AA): 1 week to 10 days: 1 credit to each Bridge course under additional learning (will be printed on grade sheet)									

@ Dean AA will allot the courses QALR (Stream-I), Soft & Interpersonal Skills (Stream-II), to the branches as per Stream-I and Stream-II.

FUNDAMENTALS OF INTERNET OF THINGS			
Class: B.Tech.III –Semester		**Branch:** CSE(Internet of Things)	
Course Code:	**U24IN301**	**Credits:**	**4**
Hours/Week (L-T-P-O-E):	**2-1-2-5-10**	**CIE:**	**60 %**
Total Number of Teaching Hours:	**60 Hrs**	**ESE:**	**40 %**

Course Learning Outcomes (COs):

After completion of this course, the students should be able to,

CO1: identify the basics of IoT, sensors, actuators and IoT boards in real time environment
CO2: make use of Arduino IDE, i/o functions for problem solving
CO3: distinguish analog and digital communications with Arduino
CO4: design a real time application using sensors, actuators and Arduino board compare
CO5: develop Arduino programming for problem solving
CO6: develop Arduino programming with LED and button
CO7: interpret analog and digital communications with Arduino
CO8: develop Arduino programming for connecting sensors and actuators to control the applications

THEORY COMPONENT

UNIT-I	9 Hrs

Introduction: Introduction to Internet of Things(IoT)**,** Evolution of IoT versus Machine to Machine (M2M), IoT versus cyber physical systems (CPS), IoT versus Web of Things (WoT), Enabled technologies, Networking components, Challenges and applications

Sensors: Definition, Characteristics, Deviations, Types-scalar, Multimedia, Hybrid and virtual, Considerations

Actuators: Definition, Types-hydraulic, Pneumatic, Electric, Thermal or Magnetic, Mechanical, Soft and shape memory polymers, Characteristics

Classification of IoT boards: Microcontroller boards, Single board controller, System on Chipboard

Self-Learning Topic(SLTs):*Addressing Strategies in IoT(Text1: topic 5.4), Wireless sensor networks(Text1: topic 3.2)*

UNIT-II	9 Hrs

Programming with Arduino: Features, Components, Integrated Development Environment(IDE), Basic programs, Time function, I/O function, Connecting Light Emitting Diode (LED) and button

NodeMCU: Components of ESP32/8266, Wi-Fi and Bluetooth connectivity, Connecting temperature sensor, controlling LED with mobile application

Self-Learning Topic(SLTs): *Arduino installation and setup(Text1: chapter 16.1.3)Esp32/8266 Installation with diode (Text1: chapter 16.1.3)*

UNIT-III	9 Hrs

Integration of Sensors: Interfacing with potentiometer, Detecting motion using PIR sensor, Measuring distance using ultrasonic sensor

Integration of Actuators: Controlling DC motor, DC motors with transistors and diode, Controlling speed with Pulse Width Modulation (PWM), Servo motor, Stepper motor

Self-Learning Topic(SLTs):*Servo motor interface with NodeMCU(Text1: chapter 16.3.7)*

UNIT-IV	**9 Hrs**

Analog and Digital Communication: Serial communication, Parallel communication

Universal Asynchronous Receiver-Transmitter (UART) Communication: send data from the Arduino to the computer via UART and receive a response, Interfacing Liquid Crystal Display(LCD)

Inter-Integrated Circuit(**I2C) Communication**: Master and slave communication, Interfacing ADXL345 module and BMP180 module

Serial Peripheral Interface (**SPI) Communication**: Master and slave communication, Interfacing with SD Card

Case Study: Smart Green House

Self-Learning Topic(SLTs): *Data transmission between NodeMCU and remote server (Text1: topic 16.3.9)*

LABORATORY COMPONENT

List of Experiments

1. Basic programming of Arduino
2. Demonstrate LED and Button
3. Demonstrate the RGB LED and 7-segment display
4. Demonstrate NodeMCU with temperature sensor
5. Demonstrate controlling LED with mobile application by using NodeMCU
6. Demonstrate interfacing of potentiometer
7. Demonstrate interfacing of PIR sensor
8. Demonstrate interfacing of infrared and ultrasonic sensor
9. Demonstrate interfacing of DC motor, servo motor and stepper motor
10. Demonstrate I2C communication protocol
11. Demonstrate UART communication protocol
12. Demonstrate SPI communication protocol

Textbook(s):

1. Sudip Misra, Anandarup Mukherjee, Arljit Roy, *INTRODUCTION TO IOT*, New Delhi: Cambridge University Press ,2020(chapter7,8)
2. Cornel Amariei, *Arduino Development Cook Book*, Birmingham: Packet Publishing Ltd., 2015(Chapter 2-6)

Reference Book(s):

1. Arshdeep Bahga and Vijay Madisetti, *Internet of Things: A Hands-On Approach,* Hyderabad: University Press, 2015
2. Marco Schwartz, *Internet of Things with ESP8266*, Birmingham: Packt Publishing Ltd.,

2016

3. Rajesh Singh, Anita Gehlot, Lovi Raj Gupta, Bhupendra Singh, Mahendra Swain, *Internet of things With Raspberry Pi and Arduino*, Boca Raton: CRC Press, Taylor & Francis Group,2020

4. Brian Evans, *Beginning Arduino Programming*, New York: Apress, 2011

Web and Video link(s):https://nptel.ac.in/courses/106105191 *NPTEL Video Lecture on internet of things*Prof. Supidmistra,Professor of CSE, IIT Kharagpur.

Laboratory Manual (for laboratory component):

1. Internet of things *Manual and Record Book,* Department of CSN, KITSW.

Course Articulation Matrix (CAM):		**U18IN301 FUNDAMENTALS OF INTERNET OF THINGS**												
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	**U18IN301.1**	2	2	2	2	1	-	-	1	-	1	1	2	2
CO2	**U18IN301.2**	2	2	2	2	1	-	-	1	-	1	1	2	2
CO3	**U18IN301.3**	2	2	2	2	1	-	-	1	-	1	1	2	3
CO4	**U18IN301.4**	2	2	2	2	1	-	-	1	-	1	1	3	3
CO5	**U18IN301.5**	2	2	2	2	1	-	-	1	-	1	1	2	2
CO6	**U18IN301.6**	2	2	2	2	1	-	-	1	-	1	1	2	2
CO7	**U18IN301.7**	2	2	2	2	1	-	-	1	-	1	1	2	3
CO8	**U18IN301.8**	2	2	2	2	1	-	-	1	-	1	1	2	3
U24IN301		2	2	**2**	2	1	-	-	**1**	-	1	1	**2**	**2.5**

CO–SDG ALIGNMENT MATRIX				
CO	**CO STATEMENT (THE STUDENT SHOULD BE ABLE TO…)**	**RELEVANT SDG**	**SDG DESCRIPTION**	**MAPPING JUSTIFICATION**
CO1	identify the basics of iot, sensors, actuators and iot boards in a real-time environment	SDG 4	Quality Education	Builds fundamental knowledge of IoT technologies, embedded systems, and real-time computing through practical learning
CO2	make use of arduino ide and i/o functions for problem solving	SDG 9	Industry, Innovation and Infrastructure	Develops technical skills in embedded programming and hardware interfacing for innovative industrial applications
CO3	distinguish analog and digital communications with arduino	SDG 9	Industry, Innovation and Infrastructure	Enhances understanding of communication techniques essential for designing reliable IoT and automation systems
CO4	design a real-time application using sensors, actuators and arduino board	SDG 11	Sustainable Cities and Communities	Enables the development of smart IoT solutions for automation, environmental monitoring, and smart city applications
CO5	develop arduino programming for problem solving	SDG 4	Quality Education	Strengthens practical programming and problem-solving skills through hands-on laboratory activities
CO6	develop arduino programming with led and button	SDG 9	Industry, Innovation and Infrastructure	Provides practical experience in embedded system design and hardware interfacing for automation applications
CO7	interpret analog and digital communications with arduino	SDG 9	Industry, Innovation and Infrastructure	Improves analytical skills in communication protocols and signal processing used in IoT systems
CO8	develop arduino programming for connecting sensors and actuators to control applications	SDG 11	Sustainable Cities and Communities	Facilitates the development of intelligent IoT-based monitoring and control systems for sustainable and smart applications

OPERATING SYSTEMS			
Class: B.Tech. III-Semester		**Branch:** CSE (Internet of Things)	
Course Code:	**U24IN302**	**Credits:**	**3**
Hours/Week (L-T-P-O-E):	**2-1-0-4-7**	**CIE:**	**60 %**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40 %**

Course Learning Outcomes (COs):

After completion of this course, the students should be able to,

CO1: use the operating system services and system calls

CO2: analyze CPU scheduling algorithms based on scheduling criteria, synchronization algorithms based on number of resource allocations

CO3: assess the deadlock problems based on mutual exclusion, hold&wait, no-preemption and circular wait conditions and memory management issues based on page page replacement techniques

CO4: evaluate file access and allocation methods based on memory space requirement, disk scheduling algorithms based on tracking time, system protection techniques based on their domains

UNIT-I	**9 Hrs**

Introduction: Operating systems fundamentals, Operating-system operations, Process management, Memory management, Input-output management, Secondary storage management, Computing environments

System Structures: Operating-system services, System calls, Types of system calls, System programs, Operating-system structure, System boot

Self Learning Topics (SLTs): *Dual mode and multi-mode operation (Text1: topics 1.5.1), Mobile computing and distributed systems (Text1: topics 1.11.2,1.11. 3), File management and device management (Text1: topics 2.4.2,2.4.3), Hybrid systems (Text1: topics 2.7.5), Threads (Text1: topics 3.1.4), Message-passing systems (Text1: topic 3.4.2)*

UNIT-II	**9 Hrs**

Process Concept: Process concept, Interprocess communication

Process Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms – first- come first serve, Shortest-job-first, Priority, Round-robin

Synchronization: Background,Thecritical-sectionproblem,Peterson's solution, Synchronization hardware, Mutex locks, Semaphores, Monitors

Self Learning Topics (SLTs): *Practice problems (Text1: Prob 6.3, 6.16, 6.17), Deadlocks and starvation and priority inversion (Text1: topics 5.6.3, 5.6.4), Implementing a monitor using semaphores (Text1: topic 5.8.3)*

UNIT-III	**9 Hrs**

Deadlocks: System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock

Memory Management: Background, Swapping, Contiguous memory allocation, Segmentation, Paging, Structure of page table-hierarchical paging, Hashed page tables, Inverted page tables

Virtual-Memory Management: Background, Demand paging, Page replacement, Allocation of frames, Thrashing

Self Learning Topics (SLTs): *No preemption and circular wait (Text1: topics 7.4.3, 7.4.4),*

Detection-algorithm usage (Text1: topics 7.6.3), Resource preemption (Text1: topics 7.7.2), Dynamic loading and dynamic linking and shared libraries (Text1: topics 8.1.4, 8.1.5), Practice problems (Text1: Prob 7.3, 7.8, 7.9, 7.22, 7.23), Practice problems (Text1: Prob 9.8, 9.21, 9.30)

UNIT-IV	**9 Hrs**

File System: File concept, Access methods, Directory structure, Implementing file systems - Allocation methods, Free space management

Mass Storage Structure: Overview of mass storage structure, Disk structure, Disk scheduling, Disk management, Swap-space management

System Protection: Goals of protection, Principles of protection, Domain of protection

Self Learning Topics (SLTs): *Solid state disks and magnetic tapes (Text1: topics 10.1.2, 10.1.3), File types and file structure (Text1: topics 11.1.3, 11.1.4), Practice problems (Text1: Prob 10.11), An Example: UNIX, An example: MULTICS (Text1: topics 14.3.2, 14.3.3)*

Course Learning Outcomes (COs):

After completion of this course, the students should be able to,

CO1: use the operating system services and system calls

CO2: analyze CPU scheduling algorithms based on scheduling criteria, synchronization algorithms based on number of resource allocations

CO3: assess the deadlock problems based on mutual exclusion, hold&wait, no-preemption and circular wait conditions and memory management issues based on page page replacement techniques

CO4: evaluate file access and allocation methods based on memory space requirement, disk scheduling algorithms based on tracking time, system protection techniques based on their domains

Textbook:

1. Abraham Silberschatz , Peter B Galvin, Gerg Gagne, *Operating System Concepts*, 10th ed., Newyork: Wiley publications, ISBN-978-1-119-32091-3, 2018

Reference Book(s):

1. Ekta Walia, *Operating System Concepts*, 2nd ed., Delhi: Khanna Publishers, ISBN-10: 9789380016658, ISBN-13: 978-9380016658, 2019
2. Dhananjay M. Dhamdhere, *Operating Systems A Concept-Based Approach*, 1st ed., Newdelhi: McGraw Hill Education, ISBN-10: 0072957697 ISBN-13: 978-0072957693, 2008
3. William Stalling, *Operating Systems*, Maxwell, McMillan International Editions, ISBN 81-203-1187- 6, 1992

Web and Video link:

https://www.youtube.com/watch?v=jciGIvn7UfM&list=PLyqSpQzTE6M9SYI5RqwFYtFYab94gJpWk,*NPTEL Video Lecture on Introduction to Operating Systems By Prof. Chester Rebeiro, IIT Madras*

Course Articulation Matrix (CAM):		**U24IN302 OPERATING SYSTEMS**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24IN302.1**	2	1	2	1	-	-	-	1	1	-	1	2	2
CO2	**U24IN302.2**	3	2	2	2	-	-	-	1	1	-	1	2	2
CO3	**U24IN302.3**	3	2	2	2	2	-	-	1	1	-	1	2	2
CO4	**U24IN302.4**	2	2	2	1	2	-	-	1	1	-	1	2	2
U24IN304		2.5	1.75	2	1.5	2	-	-	1	1	-	1	2	2

CO–SDG ALIGNMENT MATRIX				
CO	**CO STATEMENT (THE STUDENT SHOULD BE ABLE TO…)**	**RELEVANT SDG**	**SDG DESCRIPTION**	**MAPPING JUSTIFICATION**
CO1	use the operating system services and system calls	SDG 4	Quality Education	Develops foundational knowledge of operating system concepts and practical programming skills, enabling students to build strong computing competencies
CO2	analyze cpu scheduling algorithms based on scheduling criteria and synchronization algorithms based on resource allocation	SDG 9	Industry, Innovation and Infrastructure	Enhances analytical skills for designing efficient resource management and synchronization mechanisms essential for modern computing infrastructure
CO3	assess deadlock problems based on mutual exclusion, hold & wait, no-preemption and circular wait conditions, and memory management issues based on page replacement techniques	SDG 9	Industry, Innovation and Infrastructure	Promotes efficient system performance and reliability through effective deadlock handling and memory management, supporting robust software systems
CO4	evaluate file access and allocation methods, disk scheduling algorithms, and system protection techniques	SDG 16	Peace, Justice and Strong Institutions	Emphasizes secure data management, system protection, and reliable access control, contributing to secure and trustworthy digital systems

ADVANCED DATA STRUCTURES

Class: B.Tech. III–Semester		**Branch:** CSE (InternetofThings)	
Course Code:	**U24IN303**	**Credits:**	**4**
Hours/Week (L-T-P-O-E):	**2-1-2-5-10**	**CIE :**	**60 %**
Total Number of Teaching Hours:	**60 Hrs**	**ESE :**	**40 %**

Course Learning Outcomes (COs):

After completion of this course, the students should be able to,

CO1: construct binary trees and binary search trees to organise and retrieve the data

CO2: construct AVL and red-black trees to optimize database queries

CO3: develop different sorting and searching techniques

CO4: construct graphs, spanning trees and develop string matching algorithms

CO5: implement and test binary trees and binary search trees to organise and retrieve data efficiently

CO6: implement and test AVL trees and red-black trees to optimise data storage

CO7: develop and testsorting techniques on unsorted data and searching techniques to retrieve the data effectively

CO8: develop and test graphs and string manipulation algorithms to organize and retrieve the data

THEORY COMPONENT

UNIT-I	9 Hrs

Trees: Basic terminologies, Definitions and concepts, Representations of binary tree, Operations on a binary tree

Types of Binary Trees: Expression tree, Binary search tree- Searching a binary search tree, Inserting a node into a binary search tree, Deleting a node from a binary search tree

Heap Trees: Representation of a heap tree, Operations on a heap tree- Insertion, Deletion

Threaded binary trees: Representation of threaded binary trees

Self Learning Topics (SLTs): *Formation of binary tree from its traversals (Text1: topic 7.4.3.2), Determining the Height of a Binary Search Tree (Reference1: topic 10.2.4), Practice problems (Text1: Prob 7.5, Reference1: Prob 9.11, Prob 9.12, Prob 9.13)*

UNIT-II	9 Hrs

Height Balanced Binary Tree: Definition, Adelson-Velsky and Landis (AVL) rotations, Insertion operation

Red-Black Tree: Definition of a red-black tree, Operation on a red-black tree-Insertion

Splay Tree: Definition. Operations on splay tree, Splaying operation

B Trees: B tree indexing, Operations on a B tree- Inserting, Deleting

B+ Tree Indexing: Searching, Inserting, B tree vs. B+ tree

Self Learning Topics (SLTs): *Huffman's trees (Refernce1: topic 9.5), AVL tree deletion (Text1: topic 7.5.5), Practice problems (Text1: Prob 7.17)*

UNIT-III	9 Hrs

Interval Tree: Construction of interval trees

Trie Tree Indexing: Trie structure, Operations on trie, Applications of tree indexing

Sorting: Heap sort,Quick sort, Merge sort, Bitonic generator sort

Searching: Fibonacci search, Interpolation search

Self Learning Topics (SLTs):*Linked representation of binomial heap(Reference1: topic 12.2.1), operations of binomial heap(Reference1: topic 12.2.2),Jump search (Reference1: topic 14.3), Hashtree (http://originstamp.com/ blog/what-is-a-hash-tree-or-merkle-tree/)*

UNIT-IV	**9 Hrs**

Graphs: Introduction, Graph terminology, Representation of graphs

Application of Graph Structures: Topological sorting, Minimum spanning trees**-** Prim's algorithm, Kruskal's algorithm, Graphs traversal methods- Breadth first search, Depth first search, Kosaraju's algorithm

String Matching Algorithms: Brute force method, Rabin-karp string matching algorithm, Knuth morris pratt(KMP) algorithm, Boyer-moore algorithm

Self-Learning Topics (SLTs): *Directed graphs(Reference1: topic 13.3.1), practice problems (Reference1:Prob 13.18) String compression -Run Length Encoding (https://www.naukri.com/ code360/library /run-length-encoding)*

LABORATORY COMPONENT

List of Experiments

1. Program to perform following binary tree operations
   i) creation ii) insertion of a node iii) traversal using recursion
2. Program to perform following binary search tree traversal operations without recursion
   i) inorder ii) preorder iii) postorder iv) spiral order
3. Program to perform following binary search tree operations.
   i) creation ii) insertion of a node iii) deletion of a node
4. Program to implement AVL tree construction
5. Program to implement search and insert operations on Trie
6. Program to implement the following sorting techniques.
   a) Heap sort
   b) Quick sort
7. Program to implement the following sorting techniques.
   a) Merge sort
   b) Bitonic generator sort
8. Program to implement the following search algorithms.
   a) Fibonacci search
   b) Interpolation search
9. Program to implement the following
   i) Graph Representations ii) Topological sort
10. Program to implement the following graph traversal techniques.
    i) Depth first search ii) Breadth first search
11. Program to implement following shortest path algorithms.
    i) Kruskal's algorithm ii) Prim's algorithm
12. Program to implement the following string matching algorithms.
    i) Knuth morris pratt algorithm
    ii) Boyer-moore algorithm
    iii) Rabin-karp algorithm

Textbook:

1.Debasis Samanta, *Classic Data Structures*, 2nd ed., New Delhi: Prentice Hall India, 2009 (*Chapters 7 to 11*)

Reference Book(s):

1. Reema Thareja, *Data Structures Using C,* 2nd ed.,New Delhi: Oxford University Press, 2014
2. Narasimha Karumanchi, *Data Structures and Algorithms Made Easy*, 5th ed., Bombay: Careermonk, 2017

Web and Video link(s):

https://nptel.ac.in/courses/106102064 , *NPTEL Video Lecture on Data Structures and Algorithms Prof. Naveen Garg, IIT Delhi*

https://nptel.ac.in/courses/106106130, *NPTEL Video Lecture on Programming and Data Structures Dr. N. S. Narayana Swamy, CSE, IIT Madras*

Laboratory Manual (for laboratory component):

Advanced Data Structures Laboratory Manual and Record Book, Department of CSE(N), KITSW

Course Articulation Matrix (CAM):		U24IN303 ADVANCED DATA STRUCTURES												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24IN303.1	2	2	2	1	1	-	-	1	-	1	1	2	2
CO2	U24IN303.2	2	2	2	1	1	-	-	1	-	1	1	2	2
CO3	U24IN303.3	2	2	2	2	1	-	-	1	-	1	1	2	2
CO4	U24IN303.4	2	2	2	2	1	-	-	1	-	1	1	2	2
CO5	U24IN303.5	2	2	3	2	1	-	-	1	-	1	1	1	1
CO6	U24IN303.6	2	2	3	2	1	-	-	1	-	1	1	1	1
CO7	U24IN303.7	2	2	3	2	1	-	-	1	-	1	1	1	1
CO8	U24IN303.8	2	2	3	2	1	-	-	1	-	1	1	1	1
U24IN303		**2**	**2**	**2.5**	**1.75**	**1**	**-**	**-**	**1**	**-**	**1**	**1**	**1.5**	**1.5**

CO–SDG Alignment Matrix				
CO	**CO Statement (The student should be able to…)**	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	construct binary trees and binary search trees to organize and retrieve data	SDG 4	Quality Education	Develops analytical thinking and programming skills by implementing hierarchical data structures for efficient data organization and retrieval
CO2	construct avl trees and red-black trees to optimize database queries	SDG 9	Industry, Innovation and Infrastructure	Enhances the ability to design efficient and optimized data structures that improve database performance and support innovative software solutions.
CO3	develop different sorting and searching techniques	SDG 4	Quality Education	Strengthens algorithmic thinking and problem-solving skills through the implementation of efficient sorting and searching algorithms
CO4	construct graphs, spanning trees, and develop string matching algorithms	SDG 9	Industry, Innovation and Infrastructure	Builds competencies in graph theory and string processing algorithms that are

CO–SDG Alignment Matrix				
CO	**CO Statement (The student should be able to…)**	**Relevant SDG**	**SDG Description**	**Mapping Justification**
				fundamental to modern computing, networking, and intelligent applications
CO5	implement and test binary trees and binary search trees to organize and retrieve data efficiently	SDG 4	Quality Education	Provides hands-on experience in implementing and validating tree-based data structures, reinforcing practical programming and computational skills.
CO6	implement and test avl trees and red-black trees to optimize data storage	SDG 9	Industry, Innovation and Infrastructure	Develops practical skills in implementing balanced tree structures for efficient storage, retrieval, and high-performance software systems
CO7	develop and test sorting techniques on unsorted data and searching techniques to retrieve data effectively	SDG 4	Quality Education	Enhances practical knowledge of algorithm implementation, testing, and performance analysis for efficient data processing
CO8	develop and test graph and string manipulation algorithms to organize and retrieve data	SDG 9	Industry, Innovation and Infrastructure	Equips students with practical skills in graph and string algorithms that support advanced computing applications, efficient data processing, and software innovation

COMPUTER NETWORKS			
Class: B.Tech. III –Semester		**Branch:** CSE(Internet of Things)	
Course Code:	**U24IN304**	**Credits:**	**3**
Hours/Week (L-T-P-O-E):	**2-1-0-5-8**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs):

After completion of this course, the students should be able to,

CO1: evaluate the OSI and TCP/IP reference models in terms of their operational frameworks, layer functionalities, and support for switching infrastructures

CO2: analyze data link layer mechanisms and medium access control protocols to ensure efficient and reliable communication

CO3: apply routing and congestion control algorithms to optimize network performance

CO4: analyze the functionalities and performance of transport and application layer protocols by examining services like connection management, reliability, flow control, and port addressing.

THEORY COMPONENT

UNIT-I	9 Hrs

Introduction: Uses of computer networks, Types of computer networks, Network technology from local to global , Network protocols

Reference Models: OSI reference model, TCP /IP reference model

Physical Layer: Transmission media - Guided transmission media, Wireless transmission, Using the Spectrum for transmission,Communication satellites,Multiplexing

Switching: Circuit and packet switching

Self-Learning Topics (SLTs):*A critique of the OSI model and protocols(text: Topic 1.6.3), A critique of the TCP/IP reference model and protocols(Text: Topic1.6.4), Digital modulation(Text: Topic2.4.3)*

UNIT-II	9 Hrs

Data Link Layer: Data link layer design issues, Error detection and correction, Elementary data link protocols, Sliding window protocols

Medium Access Control Sub Layer: Channel allocation problem, ALOHA, Carriers sense multiple access, Collision free protocols, Limited contention protocol, Ethernet-Switched ethernet, Fast Ethernet, Gigabit Ethernet, Data link layer switching

Self-Learning Topics (SLTs):*10-Gigabit Ethernet(Text: Topic4.3.7), 40-and 100-Gigabit Ethernet(Text: Topic4.3.8),Bluetooth(Text:4.5)Virtual LANs(Text: Topic 4.7.5)*

UNIT-III	9 Hrs

Network Layer: Network layer design issues, Routing algorithms - Optimality principle, shortest path algorithm, Flooding, Distance vector routing, Link state routing, Hierarchical routing, broadcast routing, Multicast routing

Traffic Management at Network Layer: Congestion,Approaches to traffic management, Traffic aware routing, Admission control, Traffic throttling, Load shedding

Internetworking: How networks differ, Connecting heterogeneous networks, Connecting endpoints across heterogeneous networks, Internetwork routing, Packet fragmentation

Network Layer In The Internet: IP version 4 protocol, IP addresses, IP version 6 protocol, Internet control protocols, OSPF – Interior gateway routing protocol, BGP – Exterior gateway routing

protocol, Internet multicasting

Self-Learning Topics (SLTs):*Quality of service and application QOE(Text: Topic5.4),policy at the network layer(Text: Topic5.8)*

UNIT-IV	**9 Hrs**

Transport Layer: Transport services, Primitives, Elements of transport protocols – Addressing, Connection establishment and release, Error control and flow control, Multiplexing, Crash recovery, Congestion control, Internet transport protocols - UDP,TCP
Application Layer: Domain Name System (DNS), Electronic mail, World Wide Web

Self-Learning Topics (SLTs):*Streaming audio and video(Text: Topic 7.4),Content delivery(Text: Topic 7.5)*

Textbook:

1. Andrew S. Tanenbaum, David J. Wetherall, Nick Feamster, *Computer Networks*, 6th ed.,London: Pearson Education, ISBN- 978-9356063600, 2023

Reference Book(s):

2. William Stallings, *Data and Computer Communications*, 10th ed.,Pearson Education, ISBN-9780137561704, 2014
3. BehrouzForouzan, *Data Communication and Networking*, 5th ed.,*Tata McGraw Hill*, ISBN-13978-1259064753, 2017
4. Larry L. Peterson, Bruce S. Davie, *Computer Networks*, 5th ed.,*Morgan Kaufmann Publishers.*, ISBN- 978-0123850591, 2011
5. James F.Kurose and Keith W.Ross, *Computer Networking a Top-Down Approach*,7th ed.,*Pearson Education,* ISBN- 978-0133594140, 2016

Web and Video link(s):

1. *https://www.youtube.com/watch?v=O--rkQNKqlsVideo Lecture on Computer Networks and Internet Protocol, Multiplication by Prof SoumyaKantiGhosh& Prof SandipChakraborty, NPTEL IIT Kharagpur*

Course Articulation Matrix (CAM):		**U24IN304COMPUTER NETWORKS**											
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24IN304.1**	3	2	-	1	2	-	-	1	1	-	1	3	2
CO2	**U24IN304.2**	3	3	-	2	3	-	-	1	1	-	1	3	3
CO3	**U24IN304.3**	2	3	-	1	3	-	-	1	1	-	1	3	3
CO4	**U24IN304.4**	2	2	-	1	2	-	-	1	1	-	1	3	2
U24IN304		**2.5**	**2.5**	**-**	**1.25**	**2.5**	**-**	**-**	**1**	**1**	**-**	**1**	**3**	**2.5**

CO–SDG Alignment Matrix				
CO	**CO Statement (The student should be able to…)**	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	evaluate the osi and tcp/ip reference models in terms of their operational frameworks, layer functionalities, and support for switching infrastructures	SDG 4	Quality Education	Develops foundational knowledge of computer networking models and communication architectures, strengthening analytical and technical competencies in networking
CO2	analyze data link layer mechanisms and medium access control protocols to ensure efficient and reliable communication	SDG 9	Industry, Innovation and Infrastructure	Enables students to design and analyze reliable communication systems using efficient data transmission and medium access techniques that support modern network infrastructure
CO3	apply routing and congestion control algorithms to optimize network performance	SDG 9	Industry, Innovation and Infrastructure	Develops the ability to optimize network efficiency and scalability through routing and congestion control mechanisms, contributing to robust digital infrastructure
CO4	analyze the functionalities and performance of transport and application layer protocols by examining services like connection management, reliability, flow control, and port addressing	SDG 9	Industry, Innovation and Infrastructure	Enhances understanding of end-to-end communication services and protocol performance, preparing students to develop and manage efficient, reliable, and scalable networked systems

OBJECT ORIENTED PROGRAMMING THROUGH JAVA			
Class: B.Tech. III –Semester		**Branch:** CSE(Internet of Things)	
Course Code:	**U24IN305**	**Credits:**	**4**
Hours/Week (L-T-P-O-E):	**2-1-2-5-10**	**CIE:**	**60 %**
Total Number of Teaching Hours:	**60 Hrs**	**ESE:**	**40 %**

Course Learning Outcomes (COs):

After completion of this course, the students should be able to,

CO1: distinguish various programming paradigms and develop java fundamental programs
CO2: develop java programs using classes, constructors and various string concepts
CO3: make use of reusability concepts like inheritance, dynamic method dispatch, interfaces and packages to build java programs
CO4: develop java programs using I/O, exception handling and multithreading concepts
CO5: develop java fundamental programs using operators, control structures and arrays
CO6*:* develop java programs using classes, constructors and various string concepts
CO7*:* build java programs on inheritance, dynamic method dispatch, interfaces and packages
CO8*:* implement and test java programs using I/O, exception handling and multithreading Concepts

THEORY COMPONENT

UNIT-I	9 Hrs

Programming Paradigms: Procedural programming, Modular programming, Object oriented programming (OOP), Generic programming

Java Basics: The History and evolution of Java, An overview of java, Data types, Variables and arrays, Operators, Control statements

Introducing Classes: Class fundamentals, Declaring objects, Object reference variables, Introducing methods

Self Learning Topics (SLTs): *Lexical Issues like Keywords, identifiers, Literals and comments (TextBook-Chapter 2), Type conversions and casting (TextBook-Chapter 3)*

UNIT-II	9 Hrs

Classes and Methods: Overloading methods, *this* keyword, Passing and returning objects, Recursion, Variable length arguments, Constructors, Overloading constructors, Garbage collection, Static variables, Static blocks, Static methods, Nested and inner classes, Command line arguments, Wrapper classes

Strings: Exploring String, StringBuffer, StringBuilder and StringTokenizer classes

Self Learning Topics (SLTs): *Overloading Vararg Methods, Varargs and Ambiguity (TextBook-Chapter: 7),Anonymous Inner classes(TextBook-Chapter-25)*

UNIT-III	9 Hrs

Inheritance: Inheritance basics, Types of inheritance, Using *super*, Method overriding, Order of constructors Execution, Dynamic method dispatch, Abstract classes, *final* with inheritance, Object class

Interfaces: Defining an interface, Implementing interfaces, Nested interfaces, Variables in interfaces, Interfaces can be extended

Packages: Defining a package, Packages and Member Access, Importing packages

Self Learning Topics (SLTs): *Accessing implementations through interface references*, *Default*

interface methods, Use static methods in an interface, private interface methods(TextBook-Chapter-9)

UNIT-IV	9 Hrs

Using I/O: I/O basics, Reading, Writing and copying files using byte and character streams

Exception Handling: Fundamentals, Exception types, Uncaught exceptions, Using *try* and *catch*, Multiple catch clauses, Nested try statements, *throw*, *throws*, *finally, Creating your own exception sub classes.*

Multithreading: Creating a thread, Creating multiple threads, Thread priorities, Synchronization, Interthread communication

Self Learning Topics (SLTs):*try-with resource, multi catch, chained exception, precise re-throw(TextBook-Chapter: 10), Serialization- Writing and reading objects to and from the file-(TextBook-Chapter-22)*

LABORATORY COMPONENT

List of Experiments

1. a) Develop a java program to demonstrate different operators in java
   b) Develop a java program to demonstrate control structures
   c) Develop a java program to demonstrate *switch* statement
2. a) Develop a java program to read an array and display them using *for-each* control. Finally display the sum of array elements
   b) Develop a java program to read a matrix and display whether it is an identity matrix or not. Use *civilizedform* of *break* statement
   c) Develop a java program to define a two dimensional (2D) array where each row contains different number of columns. Display the 2D-array using *for-each*
3. a) Develop a java program to demonstrate class concept
   b) Develop a java program to demonstrate *this*keyword
   c) Develop a java program to demonstrate object reference variable
   d) Develop a java program to demonstrate overloading of methods
   e) Develop a java program to demonstrate passing and returning objects
4. a) Develop a java program to demonstrate variable length argument (using array and ellipsis notation)
   b) Develop a java program to demonstrate constructors and garbage collection
   c) Develop a java program to demonstrate nested and inner classes
   d) Develop a java program to demonstrate *static* variables, *static* methods, and *static* blocks
5. a) Read at least five strings from command line argument and display them in sorted order
   b) Develop a java program to demonstrate wrapper class by reading N number of integers from command line and display their sum
   c) Develop a java program to demonstrate wrapper class by reading N floating point numbers from command line and display their average
6. a) Develop a java program to accept a string, count number of vowels and remove all vowels
   b) Develop a java program to accept a string, count number of vowels and remove all vowels using *StringBuffer*class
   c) Develop a java program to accept a line of text, tokenize the line using *StringTokenizer* class and print the tokens in reverse order

7. a) Develop a java program to demonstrate single level-inheritance
   b) Develop a java program to demonstrate multilevel-inheritance using super
   c) Develop a java program to demonstrate method overriding

8. a) Develop a java program to demonstrate dynamic method dispatch
   b) Develop a java program to demonstrate use of abstract class
   c) Develop a java program to demonstrate the use of overriding *equals()* method of an Object class

9. a) Develop a java program to implement interfaces
   b) Develop a java program to extend the interfaces
   c) Develop a java program to demonstrate implementation of nested interfaces

10. Develop a java program to create a *package*, and demonstrate to import the *package* into any java program (Consider the behavior of all access specifiers)

11. a) Develop a java program to demonstrate *try-catch* block
   b) Develop a java program to demonstrate *throw* clause
   c) Develop a java program to demonstrate *throws* clause
   d) Develop a java program to demonstrate *re-throw* an exception, and *finally* block

12. a) Develop a java program to demonstrate read/write/copy a file using *byte stream*
   b) Develop a java program to demonstrate read/write/copy a file using *character stream*
   c) Develop a java program to create a thread (using *Thread*class or *Runnable* interface)
   d) Develop a java program to demonstrate *synchronization* of threads
   e) Develop a java program to demonstrate *Interthreadcommunication*

Textbook(s):

1. HerbertSchildt, *Java TheComplete Reference*, 13th ed., New Delhi: McGraw-Hill Education, 2019

Reference Book(s):

1. Balaguruswamy, *Programming with Java: A Primer*, 7th ed., New Delhi: McGraw-Hill Education India Pvt. Ltd.,2019
2. KathySierra, BertBates, *Head First Java,* 2nd ed., Boston:O'Reilly Publications, 2005,
3. Harvey Deitel, Paul J. Deitel, *Java How to Program,* 11thed., India:Pearson Publications, 2018

Web and Video link(s):

https://nptel.ac.in/courses/106105191*NPTEL Video Lecture on Java Programming* by Prof. Debasis Samanta,Professor of CSE, IIT Kharagpur.

Laboratory Manual (for laboratory component):

1. *Object Oriented Programming through java Manual and Record Book,* Department of CSE (Networks), KITSW.

Course Articulation Matrix (CAM):		U24IN305 : OBJECT ORIENTED PROGRAMMING THROUGH JAVA												
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24IN305.1	2	2	2	-	1	-	-	1	1	-	1	1	1
CO2	U24IN305.2	2	2	2	1	2	-	-	1	1	-	1	1	1
CO3	U24IN305.3	2	2	3	2	1	-	-	1	1	-	1	2	2
CO4	U24IN305.4	2	2	3	2	2	-	-	1	1	-	1	2	2
CO5	U24IN305.5	1	1	1	1	1	-	-	1	1	-	1	1	1
CO6	U24IN305.6	1	2	2	2	2	-	-	1	1	-	1	1	1
CO7	U24IN305.7	1	2	3	2	2	-	-	1	1	-	1	2	2
CO8	U24IN305.8	1	2	3	2	2	-	-	1	1	-	1	2	2
U24IN305		1.5	1.87	2.37	1.5	1.62	-	-	1	1	-	1	1.5	1.5

CO–SDG Alignment Matrix				
CO	CO Statement (The student should be able to…)	Relevant SDG	SDG Description	Mapping Justification
CO1	distinguish various programming paradigms and develop java fundamental programs	SDG 4	Quality Education	Develops foundational programming knowledge, computational thinking, and problem-solving skills through Java programming concepts
CO2	develop java programs using classes, constructors, and various string concepts	SDG 4	Quality Education	Enhances object-oriented programming skills and strengthens software development capabilities through practical implementation of Java concepts
CO3	make use of reusability concepts like inheritance, dynamic method dispatch, interfaces, and packages to build java programs	SDG 9	Industry, Innovation and Infrastructure	Promotes innovative software development by applying object-oriented design principles that support modular, reusable, and scalable applications
CO4	develop java programs using i/o, exception handling, and multithreading concepts	SDG 9	Industry, Innovation and Infrastructure	Enables students to build robust, efficient, and reliable software systems using advanced Java programming techniques
CO5	develop java fundamental programs using operators, control structures, and arrays	SDG 4	Quality Education	Strengthens programming fundamentals and logical reasoning through hands-on implementation of core Java constructs

CO–SDG Alignment Matrix				
CO	**CO Statement (The student should be able to…)**	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO6	develop java programs using classes, constructors, and various string concepts	SDG 4	Quality Education	Improves object-oriented programming proficiency and practical coding skills required for software development
CO7	build java programs on inheritance, dynamic method dispatch, interfaces, and packages	SDG 9	Industry, Innovation and Infrastructure	Develops reusable and maintainable software solutions by applying advanced object-oriented programming concepts used in industry
CO8	implement and test java programs using i/o, exception handling, and multithreading concepts	SDG 9	Industry, Innovation and Infrastructure	Equips students with practical skills to implement, test, and optimize Java applications for real-world software engineering environments

SOFT AND INTERPERSONAL SKILLS LABORATORY			
Class: B.Tech. III -Semester		**Branch:** Common to all Branches	
Course Code:	**U24VA306B**	**Credits:**	**1**
Hours/Week (L-T-P-O-E):	**0-0-2-2-4**	**CIE:**	**100 %**
Total Number of Teaching Hours:	**24 Hrs**	**ESE:**	**-**

Course Learning Outcomes (COs):

After completion of this course, the students should be able to…

CO1: deliver concise & effective self-introduction and demonstrate confidence, spontaneous speaking skills within a limited time

CO2: conduct a personal SWOT analysis to identify areas for self-improvement and career development

CO3: demonstrate clear & respectful communication, leadership, positive attitude and improve interpersonal relationship by actively participating in group discussions, collaborative tasks & mock interviews

CO4: create a professional resume, develop a LinkedIn profile and demonstrate effective video communication by making effective videos on self-introduction, personal SWOT analysis & spontaneous speaking activity along with email & workplace etiquette

LIST OF ACTIVITIES

Activity 1: Ice-breaking, Self-Awareness and Just a Minute (JAM)
Activity 2: Self-Introduction & Personal SWOT Analysis
Activity 3: Reading Comprehension & Critical Thinking
Activity 4: Active Listening & Non-Verbal Observation (Video + Peer Practice)
Activity 5: Group Discussion - 1
Activity 6: Resume Building & LinkedIn Profile Review
Activity 7: Group Discussion - 2
Activity 8: Presentation Skills with PPT / Storytelling
Activity 9: Group Discussion - 3
Activity 10: Mock Interviews: Technical & HR
Activity 11: Email Etiquette & Professional Communication
Activity 12: Workplace Etiquette & Conflict Resolution

Textbook(s):

1. Krishna Mohan & Meera Benerji, *Developing Communications Skills*, 2nd ed., New Delhi: Mcmillan Publications, 2005

Course Articulation Matrix (CAM):		U24VS306B SOFT AND INTERPERSONAL SKILLS LABORATORY												
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24VA306B.1	-	-	-	-	-	-	-	2	3	-	1	1	1
CO2	U24VA306B.2	-	-	-	-	-	-	2	3	3	-	1	1	1
CO3	U24VA306B.3	-	-	-	-	-	-	-	2	3	-	1	1	1
CO4	U24VA306B.4	-	-	-	-	-	-	1	2	3	-	1	1	1
U24VA306B		-	-	-	-	-	-	1.5	2.25	3	-	1	1	1
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	CO Statement (The student should be able to…)	Relevant SDG	SDG Description	Mapping Justification
CO1	deliver a concise and effective self-introduction and demonstrate confidence and spontaneous speaking skills within a limited time	SDG 4	Quality Education	Enhances communication, confidence, and presentation skills, preparing students for lifelong learning and professional success through effective self-expression
CO2	conduct a personal swot analysis to identify areas for self-improvement and career development	SDG 4	Quality Education	Promotes self-assessment, lifelong learning, and continuous personal and professional development by identifying strengths, weaknesses, opportunities, and threats
CO3	demonstrate clear and respectful communication, leadership, positive attitude, and improve interpersonal relationships by actively participating in group discussions, collaborative tasks, and mock interviews	SDG 16	Peace, Justice and Strong Institutions	Develops interpersonal, leadership, teamwork, and ethical communication skills that foster inclusive, respectful, and collaborative environments in academic and professional settings
CO4	create a professional resume, develop a linkedin profile, and demonstrate effective video communication by preparing videos on self-introduction, personal swot analysis, and spontaneous speaking activities along with email and workplace etiquette	SDG 8	Decent Work and Economic Growth	Equips students with professional employability skills, digital presence, workplace communication, and career readiness, supporting access to decent work and sustainable economic growth

PROGRAMMING SKILL DEVELOPMENT LAB-2			
Class: B.Tech. III –Semester		**Branch:** CSE(Internet of Things)	
Course Code:	**U24SE307**	**Credits:**	1
Hours/Week (L-T-P-O-E):	**0-0-2-2-4**	**CIE:**	100%
Total Number of Lab Hours:	**36 Hrs**	**ESE:**	-

Course Learning Outcomes (COs):
After completion of this course, the students should be able to …
(based on psychomotor skills acquired from laboratory component):
CO1:develop programs on arrays including searching and sorting
CO2:develop programs on strings and DMA
CO3: develop programs on stacks
CO4: develop programs on queues and hashing

LABORATORY COMPONENT

Sl.No	List Of Experiments
1	Implementation of arrays
2	Implementation of searching techniques
3	Implementation of sorting techniques
4	Implementation of string operations
5	Implementation of string operations
6	Implementationof dynamic memory allocation function
7	Implementation of linked list operations using c
8	Implementation of stacks operationsusing c
9	Implementation of stacksoperations using c
10	Implementation of queues operations
11	Implementation of queuesoperations
12	Implementationof hashing function

Textbook:
1.Balagurusamy.E, *Programming in ANSI C*, 8th ed., 2022

Reference Book(s):

1. Paul Deitel, Harvey Deitel, C How to Program: With Case Studies *Introducing Applications Programming and Systems Programming*, Pearson Education Limited, 9th ed., 2022
2. Brian W. Kernighan and Dennis Ritchie, *The C Programming Language*, Pearson EducationIndia, 2nd ed., 2015
3. Reema Thareja, *Programming in C*, Oxford University Press, 3rd ed., 2023
4. Yashavant Kanetkar, *Let Us C*, BPB Publications, 19th ed., 2022
5. A.K.Sharma,*Computer Fundamentals and Programming in C*, Universities Press, 2nd ed., 2018

Course Learning Outcomes (COs):
After completion of this course, the students should be able to …
(based on psychomotor skills acquired from laboratory component):
CO1:develop programs on arrays including searching and sorting
CO2:develop programs on strings and DMA
CO3: develop programs on stacks
CO4: develop programs on queues and hashing

Course Articulation Matrix (CAM):		U24SE307 Programming Skill Development Lab2												
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PS O1	PS O2
CO1	U24SE307.1	2	2	1	1	1	-	-	1	1	-	1	1	2
CO2	U24SE307.2	2	2	1	1	1	-	-	1	1	-	1	1	2
CO3	U24SE307.3	2	2	1	1	1	-	-	1	1	-	1	1	2
CO4	U24SE307.4	2	2	1	1	1	-	-	1	1	-	1	1	2
U24SE307		2	2	1	1	1	-	-	1	1	-	1	1	2

CO–SDG Alignment Matrix				
CO	Co Statement (The Student Should Be Able To...)	Relevant SDG	SDG Description	Mapping Justification
CO1	develop programs on arrays including searching and sorting	SDG 4	Quality Education	Students Acquire Practical Programming And Problem-Solving Skills By Implementing Array Operations, Searching, And Sorting Algorithms, Promoting Quality Technical Education And Lifelong Learning
CO2	develop programs on strings and dynamic memory allocation (dma)	SDG 4	Quality Education	Students Develop Programming Proficiency Through String Manipulation And Dynamic Memory Management, Strengthening Computational Thinking And Software Development Skills
CO3	develop programs on stacks	SDG 9	Industry, Innovation And Infrastructure	Students Implement Stack-Based Applications That Serve As The Foundation For Compiler Design, Expression Evaluation, And Efficient Software Systems, Fostering Innovation And Technological Development
CO4	develop programs on queues and hashing	SDG 9	Industry, Innovation And Infrastructure	Students Gain Practical Knowledge Of Queue And Hashing Techniques Used In Modern Computing Applications, Enabling The Development Of Efficient And Scalable Software Solutions

PRACTICUM-3			
Class: B.Tech. III -Semester	**Branch:** Common to all branches		
Course Code:	**U24EL308**	**Credits:**	**1**
Hours/Week (L-T-P-O-E):	**0-0-0-4-4**	**CIE Marks :**	**100%**
Total Number of Teaching Hours:	**-**	**ESE Marks :**	**-**

Course Learning Outcomes (COs):

After completion of this course, the students should be able to…

CO1: synthesize literature survey, identify research gaps and define objective & scope of practicum problem

CO2: apply knowledge to design & conduct experiments, utilize modern tools for solution of practicum problem and develop working model/ process/ system

CO3: demonstrate the generic competencies in making a well-documented report portraying knowledge, skills, qualities acquired through practicum

CO4: create a video pitch on practicum and make an effective oral presentation using PPTs

Practicum is an independent project carried out by the student during the course period, under the supervision of allotted course faculty. It helps to reinforce the students' theoretical knowledge and develop their ability to apply this knowledge to the solution of practical problems. Practicums also prepare them for their MINI and MAJOR PROJECTs and for independent work in their chosen field that promotes creative abilities. Besides they provide Higher Order Cognitive Abilities (HOCAs).

(x). Practicum is a mandatory semester project work.

(xi). Practicum is offered as a one credit course. Student has to earn 4 credits (one in each semester from I to IV semesters)

(xii). Allotment of Practicum topics for students:

- **Practicum matrix:** In week (-1), the class teacher, in consultation with HoD, shall prepare the practicum matrix of the section. The practicum matrix is the allotment of group of students to the different course faculty of the section, as shown below.

Course	U24IN301	U24IN302	U24IN303	U24IN304	U24IN305	U24IN306
Students allotted to different courses	B24XX001	B24XX011	B24XX021	B24XX031	B24XX041	B24XX051
	B24XX002	B24XX012	B24XX022	B24XX032	B24XX042	B24XX052
	B24XX003	B24XX013	B24XX023	B24XX033	B24XX043	B24XX053
	B24XX004	B24XX014	B24XX024	B24XX034	B24XX044	B24XX054
	B24XX005	B24XX015	B24XX025	B24XX035	B24XX045	B24XX055
	B24XX006	B24XX016	B24XX026	B24XX036	B24XX046	B24XX056
	B24XX007	B24XX017	B24XX027	B24XX037	B24XX047	B24XX057

	B24XX008	B24XX018	B24XX028	B24XX038	B24XX048	B24XX058
	B24XX009	B24XX019	B24XX029	B24XX039	B24XX049	B24XX059
	B24XX010	B24XX020	B24XX030	B24XX040	B24XX050	B24XX060

- In week (-1), the class teacher of a section shall collect 10-12 topics for practicum from each of the course teachers of that section.
- The class teacher, in consultation with HoD shall allot the practicum topics to the students of that section in the following format.

****

CIRCULAR

Allotment of Practicum topics to students

Section : …….

No.	Roll number of the student	Practicum topic allotted	Practicum under the course	Course faculty

Note:

4. The students should meet immediately the allotted course faculty for practicum and start working on the practicum with the guidance of course faculty.
5. To complete the Practicum, the student shall work in laboratories under supervision of allotted course faculty, in the allotted hours in the classwork timetable and also outside the class work hours during weekdays.
6. The course faculty are advised to guide the allotted students for practicum during the semester course work.

(Signature of class teacher)

****

(xiii). ***To complete the practicum, the student shall work in laboratories under supervision of allotted course faculty, in the allotted hours in the classwork timetable and outside the class work hours during weekdays.***

(xiv). There shall be only continuous Internal Evaluation (CIE) for practicum for a maximum of 100 marks.

(xv). The practicum course faculty shall evaluate & submit the final marks of the allotted students in week (N+1) to the respective class teacher.

(xvi). The class teacher shall collect the final marks of practicum of the students allotted to each course teacher and submit them to the CoE.

xvii). Course faculty shall follow his/her own rubrics for practicum evaluation. Focus shall be on knowledge, skills & qualities acquired by the student during the practicum course

xviii). A sample rubrics for assessment and evaluation of practicum is as follows:

Literature survey & Identification of research gaps	10 marks
Working model / process / software package / system developed	30 marks
Report writing (subjected to max of 30% plagiarism)	20 marks
Oral presentation with PPT and viva-voce	20 marks
Video pitch	20 marks
Total	100 marks

Note: It is mandatory for the student to appear for oral presentation and viva-voce to qualify for course evaluation of Practicum.

(h) **Practicum Topic**: Each student shall be allotted a topic for practicum by the course faculty member attached to him/her. Interested students can work on their own title for practicum, but with due approval from course faculty.

(i) **Working Model**: Each student is required to develop a prototype / process / system/simulation model on the given practicum topic and demonstrate/present, during the allotted time, before the course teacher.

(j) **Report:** Each student is required to submit a well-documented report on the allotted practicum topic as per the format specified by the course faculty. The student shall include answers to the following questions in the report and ppt presentation.

- What was the objective of the practicum assigned?
- What are the main responsibilities and tasks for practicum?
- What knowledge and skills from the coursework are applied in the practicum?
- What new knowledge and skills are acquired during the practicum?
- In what ways, can the practicum be helpful for the professional career?
- What gaps are identified in your practicum work?
- What improvements or changes you suggest for addressing the identified gaps for future work?

(k) **Anti-Plagiarism Check:** The practicum report should clear plagiarism check as per the Anti-Plagiarism policy of the institute

(l) **Presentation:** Each student should prepare PPT with informative slides and make an effective oral presentation before the course teacheras per the schedule notified by the department

(m) **Video Pitch:** Each student should create a pitch video, which is a video presentation on his / her Practicum. Video pitch should be no longer than 5

minutes by keeping the pitch concise and to the point, which shall also include evidence like videos & pics at the time of implementing the practicum and also key points about his / her business idea / plan (*if any*) and social impact

(n) The student has to register for the Practicum as a supplementary examination in the following cases:

iv) he/she is absent for oral presentation and viva-voce

v) he/she fails to submit the report in prescribed format

vi) he/she fails to fulfill the requirements of Practicum evaluation as per specified guidelines

SOCIAL EMPOWERMENT ACTIVITY / SELF ACCOMPLISHMENT ACTIVITY (SEA-III /SAA-III)			
Class: B.Tech. III Semester	**Branch:** Common to all branches		
Course Code:	**U24VA309XXXXX**	**Credits:**	**1**
Hours/Week (L-T-P-O-E):	**0-0-0-2-2**	**CIE:**	**100%**
Total Number of Teaching Hours:	**-**	**ESE :**	**-**

Course Learning Outcomes (COs):

After completion of this course, the students should be able to…

CO1: integrate the five dimensions of physical, emotional, cognitive, spiritual and social aspects in life for holistic development and demonstrate social sensibility

CO2: interact effectively through written, oral and nonverbal communication with external-world in a professional, sensitive and culturally relevant manner

CO3: analyse the issues related to social empowerment / self-accomplishment, demonstrate problem-solving skills, articulate solutions and demonstrate social sensibility

CO4: demonstrate the generic competencies in making a well-documented report and an effective oral presentation with PPTs portraying knowledge, skills, qualities acquired through fieldwork/practice sessions and social impact of the course learning

Activity Based Liberal Learning about Life, Literature and Culture (ABLL@LLC) is introduced for building **generic competencies** in students. ABLL is aimed at all dimensional holistic growth of the learner. The holistic development includes the **physical, emotional, cognitive, spiritual and social aspects**. This is an area which opens the decision-making process, helps the student to develop creativity, an analytical mind, and builds resilience, confidence, hope, well-being and success. This will help student face the world with a greater degree of maturity, stoic and become a wholesome person in the society.

It is more than just learning from books to lead a successful life. These activity-based liberal learning courses, which help students to expand their social roles later in life, are offered under two sequels namely **SEA** (Social Empowerment Activities) and **SAA** (Self Accomplishment Activities)

These SEA/SAA courses also focus on building positive mindset: adopting optimism, acceptance, resilience, gratitude, mindfulness, and integrity in your life will help student develop and maintain a positive mindset.

(f) Each SEA/SAA activity is treated as one credit course

(g) Student must select one activity per semester, through first 04 semesters, from the courses listed under SEA/ SAA, before commencement of the semester.

(h) Students are required to earn minimum 04 credits under SEA/SAA, by completing minimum 02 credits through SEA and minimum 02 credits through SAA

(i) To complete these activities student shall work outside the class work hours, during weekends, holidays, semester breaks, etc.,

(j) If a student is not able to attend/ fulfil performance requirements, he/she shall be dropped from the course and shall have to enrol in the forthcoming semesters.

Monitoring SEA/SAA:

(h) **Nodal units:** The Student Activity Centre (SAC) and Centre for Innovation Incubation Research and Entrepreneurship (C-i²RE) shall act as nodal units for activities listed

under SEA/SAA.

(i) During the semester period, the student has to **acquire requisite knowledge**, **conduct fieldwork**, acquire skills and propose unique solutions to the real-life problems

(j) **Knowledge Acquisition & Skilling**:

iv. Students have to identify goals, acquire and accumulate knowledge on the chosen SEA/SAA activity

v. For the activities related to social awareness/issues/challenges that affect society, use the knowledge base, apply relevant skills to analyse the issue and propose unique possible solutions to the social issues/challenges. Practice to acquire necessary skills to seek new opportunities in their personal and professional life.

vi. For the activities related to physical fitness, music, dance, fine arts, etc., guided practice sessions under supervision of expert/guru are to be planned and executed to acquire the benchmark skills to be demonstrated.

(k) **Fieldwork:** Fieldwork is an essential component of learning for gaining real-life experiences. In addition to knowledge acquisition & skilling, student has to take up fieldwork on the chosen activity, as part of SEA/SAA course.

xv. This student-driven Fieldwork allow students to interact with the 'real world'. It is an autonomous learning (self-learning) situation that students are more actively involved during the activity and develop a deeper understanding and develop a more positive attitude.

xvi. Fieldwork consists of three phases: preparation, the actual activity and feedback

xvii. As part of fieldwork, student has to interact with at least two eminent personalities/achievers/renowned persons/inspiring and great personalities related to the activity chosen.

xviii. Fieldwork will benefit students for any careers where they need to work with communities of people or which involves analysis of complex processes, especially social and cultural.

xix. Certain skills are required for effective fieldwork, which include observation, communication, interviewing, problem solving, documentation, and more

xx. Other skills important for fieldwork practice include the ability to act in a crisis, to plan, set priorities, mobilize resources, and implement the plan effectively. These skills used in an integrated manner help students solve their problems and to develop one's own leadership style based on the need and culture of the place.

xxi. **Eminent personalities/achievers/renowned persons/inspiring and great personalities**

Eminent personalities/ Achievers / Renowned personalities:

(a). **In case of socially relevant problems/ activities of SEA/SAA: E**minent personalities/ achievers include district administrative officers, Eminent Social workers / NGOs, other inspiring and great personalities

(b). **In case of Sports / Games and Cultural activities of SEA/SAA:** Eminent coaches/ trainers/gurus, achievers who represented/won state level/national level /international level competitions, other inspiring and great personalities.

xxii. **For appointment to interact eminent personalities**: Student is expected to follow email etiquette rules and other appropriate polite communication etiquettes for getting appointment and time for interaction

xxiii. On fieldwork, student is expected to demonstrate solid time management,

organisational and note taking skills during fieldwork

xxiv. **Ethics of fieldwork**: Fieldwork is an educational process with commitment to positive values. All fieldwork should be planned and conducted in a way that is ethical, responsible and safe, for people, students, visited communities, if any, and all other stakeholders. Student is expected to maintain integrity and honesty. Avoid bias and deception. Protect the rights and well-being of people involved in fieldwork. The privacy, confidentiality and respect for the eminent people interacted should be maintained and their time, inputs & guidance are to be acknowledged

xxv. Student is expected to take care of health and Safety practices for fieldwork and travel

xxvi. Student should remember that contrary to a *field trip or company visit*, **the emphasis in fieldwork is on acquiring skills**, and not on casually presenting theory and assessing.

xxvii. For the fieldwork, student shall go with a scientifically designed questionnaire and record the responses during interaction. These response sheets, along with geo-tagged pic of fieldwork (at the time of interaction & practise sessions, if any) shall be appended as annexures in the report to be submitted for course evaluation.

xxviii. **Feedback:** The learnings the student made out of interaction with eminent achievers shall be presented in the report as one of the chapters.

- During feedback, the central focus is on the elaboration of the students' experience during fieldwork. Therefore, the student should create an end product, such as a demonstration/presentation and report in which they demonstrate a link between their experiences during fieldwork and the underlying theoretical concepts and ideas.

(l) **Demonstration / Presentation and Report**: Student after presentation/demonstration of his/her achievements/work, shall get a certificate from the concerned nodal unit and submit a report, in the prescribed format, to the faculty counsellor for award of grade.

(m) **Flow process for completion of SEA/SAA course**:

vi. ***Faculty counsellor approval***: In week (-1), in consultation with faculty counsellor, every student shall, identifies minimum of 4 activities listed under SEA/SAA activities, lists their priority and fills the same in ONLINE REGISTRATION FORM FOR SEA/SAA (received in their domain mail id) to Dean, Student Affairs. Dean, Student Affairs shall release the section wise allotment of SEA/SAA courses to students along with the details of supervising faculty of nodal centre. The allotment details shall be shared to the SEA/SAA coordinator and the student through domain mail id of the student

vii. ***Identification of goals and preparation of action plan:*** In week (1), the respective faculty coordinator(s) of nodal centres shall address the students allotted to them to educate them on fixing goals, plan of action for completion and evaluation. In consultation with nodal centre, based on the workflow of the allotted activity, every student shall identify the goals (of activity) & eminent personalities (to be visited during the field trip) and prepare action plan (oriented workflow) for attaining the identified goals.

viii. ***Field work:*** Under the guidance of nodal centre, student shall complete the field work, based on the action plan, with the progress continuously monitored by

the faculty counsellor and the nodal centre.

ix. ***Demonstration/ Presentation:*** After completion of field work, student shall demonstrate/present his achievements (knowledge/skills gained during the activity) at the nodal centre in the presence of external experts/senior practitioners of the activity. After successful demonstration/presentation, the nodal centre shall provide a certificate of completion indicating that the student has completed the activity in the stipulated time.

x. ***Report writing:*** After successful demonstration/presentation, student shall write a 2–3-page report and submit the same to the faculty counsellor. The report shall emphasize knowledge, skills and qualities acquired through the SEA/SAA activities. It shall also include the influence of these activities on enhancing confidence, positive change in life, decision making, transforming choices into desired actions/outcomes.

(n) ***Assessment & Evaluation:*** There shall be *only Continuous Internal Evaluation (CIE) for SEA/SAA*. The SEA/SAA activities shall be evaluated at the end of the semester through respective evaluation processes, which shall include field work, presentation/ demonstration, submission of reports on the gathered data/information/ surveys, the details of which have been shown in below table. The department level SEA/SAA coordinator shall collect marks from the nodal centres and faculty counsellors, consolidate them, and submit the final grades to the examination branch, within one week of the last day of instruction. Evaluation of SEA/SAA activities shall be completed as and when students are ready, but not later than week (N+1).

The CIE for SEA/SAA is as follows:

Assessment	**Maximum marks**	**Marks to be awarded**
Goal setting, Planning & Knowledge Acquisition	20	Nodal centre
Field work	40	Nodal centre
Demonstration/Presentation	20	Nodal centre
Report submission	20	Faculty counsellor
Total	**100**	**-**

Note:

(f) **<u>Presentation/ Demonstration:</u>** It is mandatory for the student to appear for demonstration and (or) oral presentation oral presentation to qualify for course evaluation. In case of presentation, student should prepare PPT with informative slides including the geo tagged photos of his/her field trips/interactions as per the schedule notified by the nodal centre. In case of demonstration, student must take timeslot from the nodal centre and demonstrate the skills learnt/improved during the allotted timeslot.

- The necessary arrangements for demonstration shall be looked after the student in consultation with the coordinator with due permission from Head of the

department.

(g) **Report:** Each student is required to submit a well-documented report on the chosen SEA/SAA topic as per the format specified by *department level SEA/SAA coordinator.*

(h) **Anti-Plagiarism Check:** The SEA/SAA report should clear plagiarism check as per the Anti-Plagiarism policy of the institute.

(i) **Requirements for passing the course:** A student is deemed to have passed SEA/SAA if he/she
   a. successfully demonstrates/presents the skills attained at the end of course as per the schedule notified by the nodal centre, **and**
   b. scores a minimum of 40 marks in the CIE of the course

(j) **Supplementary examination:** If a student fails in SEA/SAA activity of a particular semester, he must complete the same by enrolling it in the next higher semesters.

Text / Reference book(s):

For knowledge acquisition, students shall refer to textbooks and web resources relevant to the course selected. Plan for fieldwork/practice sessions in coordination with SEA/SAA coordinator

EXPERT TALK SERIES-III			
Class: B.Tech. III -Semester	**Branch:** Common to all branches		
Course Code:	**U24AE310**	**Credits:**	**1**
Hours/Week (L-T-P-O-E):	**0-0-0-1-1**	**CIE Marks :**	**100%**
Total Number of Teaching Hours:	**-**	**ESE Marks :**	**-**

Course Learning Outcomes (COs):

After completion of this course, the students should be able to…

CO1: identify real-world problems, different career paths, industry requirements, emerging job roles, business practices and exploit new opportunities by staying up-to-date with industry knowledge, trends and technology

CO2: identify what 21st century employability-related skills and professional etiquette are must in a range of recruitment situations, what skills are absent in him/her, and demonstrate skill improvement

CO3: interact with experts, exhibit confidence, demonstrate improved communication and networking abilities potentially leading to mentorship opportunities, internships, or even future job prospects

CO4: demonstrate the generic competencies in making a well-documented report portraying knowledge, skills, qualities acquired through ETS sessions and impact of the expert talks

In the 21st century, for successful career, degree alone won't suffice. Competencies are much more important.

(q) You need to be aware of the real-world problems, industry working style, need to be confident and smart and you also need to know the tricks of the trade.

(r) Learning from industry experts with real-world examples, is important to enhance your educational experience.

(s) Enhanced graduate employability benefits all stakeholders. To effectively enhance employability and the immediacy of adding value to company/project, it is important that you are aware of what you are learning and its use in the workplace. The cognitive abilities viz., remember, understand, recall, and application of knowledge and other skills acquired in higher education can be maximised if you are clear on the purpose of your developed competencies and how to apply them in a range of complex situations.

(t) Graduate employability could be enhanced through fostering lifelong learning, the development of a range of employability-related competencies and increased confidence and capacity in "reflecting on and articulating these capabilities and attributes in a range of recruitment situations".

But how would you know all this without venturing into the industry?

(u) The answer is Industry **Expert Talk Series (ETS)**. Through ETS, we invite industry experts in different fields to deliver talks and interact with students.

(v) Through Industry expert talks students get to know so much more that textbooks don't explain.

(w) Students have the opportunity to learn from professionals who have achieved success in their respective fields. These speakers often share their personal

experiences, case studies, and anecdotes, providing students with real-world examples and perspectives that go beyond theoretical concepts.

(x) Our competency-focussed curriculum URR24 is designed to contribute greatly to the nurturing and development of each of these facets among students through ETS courses

(y) ETS helps students gain improved industry engagement for an easier transition into the workplace, broader career progression opportunities and personal development.

(z) In URR24 curriculum, Expert talk series (ETS) is offered as a course under **ability enhancement category of courses**.

(aa) Through ETS sessions, students get the chance to interact with industry regularly which helps them focus on the needs and requirements of current industry. This will not only enthuse the students with new ideas but also motivate them to understand what kind of 21st century skills are needed in industry and how they need to groom themselves.

(bb) Through ETS sessions, another benefit is that students learn the importance of soft skills like communication, presentation, email etiquettes, corporate grooming and dressing styles. Conversing with successful people is the biggest motivation and students gain in more ways than one through ETS sessions.

(cc) ETS enhances your learning in many ways for global opportunities for your career.

(dd) All in all, learning from industry experts**,** is a wonderful opportunity for student to getting acquainted with professional etiquette, acquiring professional knowledge, and getting to know the internal workings of an organization.

(ee) Salient features of ETS are hereunder:

(xii) ETS is offered from I semester to VI semester.

(xiii) ETS, in any given semester, is treated as one credit course

(xiv) Students are required to earn six credits (from I to VI semester)

(xv) **Head, Centre for i²RE** shall be the **institute level ETS coordinator**

(xvi) Under this course, a minimum of 10 expert talks shall be organized in **online/offline mode** by the parent department / Centre for i²RE.

(xvii) Each expert talk shall be for a minimum duration of 45 minutes (*but not exceeding 90 minutes*) followed by **online quiz/test** for 10 marks (10 MCQs/FiBs , *duration: 10-15 mins*), on the contents covered in the expert talk.

(xviii) **The Head C-i²RE** shall share the marks obtained by the students in each of the quizzes / tests to the respective **department ETS coordinators.**

(xix) Each student shall attend a minimum of 6 expert talks and attempt the corresponding quizzes/ tests conducted at the end of the talks.

(xx) **Report on ETS:** At the end of semester, the student shall submit a well-documented report on the acquired knowledge and skills, in the prescribed format, to the department ETS coordinator.

(xxi) **Evaluation:** There shall be only continuous Internal Evaluation (CIE) for ETS for a maximum of 100 marks

(xxii) The department ETS coordinator shall, in coordination with institute level ETS coordinator, submit the final scores to the CoE in week (N+1).

(ff) The CIE for ETS is as follows:

Rubrics for evaluation of ETS

Quiz score	60 marks

(*sum of best 6 quiz scores out of 10 quizzes. Each quiz evaluated for 10 marks*)	
Attendance (*out of 10 quizzes*)	20 marks
Report in prescribed format (*max 30% plagiarism*)	20 marks
Total	100 marks

ii. **Attendance**: Maximum of 20 marks shall be awarded based on the attendance maintained by the student over a maximum of 10 lectures.

$$Marks\ for\ attendance = \frac{Number\ of\ expert\ talks\ attended\ fully}{10} * 20$$

iii. Supplementary Exam:

(e) Student has to register for ETS supplementary examination if he/she scores less than 40 marks in CIE

(f) The ETS supplementary examination shall be conducted by the parent department, in physical mode, for 100 marks (MCQs/FiBs , *duration: 2Hrs*) on the content covered in ETS lectures.

(g) Department ETS coordinator shall, in coordination with the institute level ETS coordinator, conduct the supplementary exam, and submit scores to the CoE

(h) Exam material/resources for supplementary: Recorded videos of ETS arranged for that semester, which shall be made available on ETS webpage of institute website

IV SEMESTER

S. No.	Category	Course Code	Course Title	Lectures / week				Credits
				L	T	P	E	C
1	BSC	U24MH401D	Discrete Mathematics and Probability, Statistics	2	1	-	3	3
2	PCC	U24IN402	Web Technologies	2	1	-	3	3
3	PCC	U24IN403	Database Management Systems	2	1	-	3	3
4	PCC	U24IN404	IoT Architectures and Protocols	2	1	-	3	3
5	PCC	U24IN405	Python Programming for IoT	2	1	-	3	3
6	VAC	U24VA406A	Quaniative Apitude ad Logical Reasoning	2	-	-	2	2
7	SEC	U24SE407	Programming ad Skill Development Laboraory	-	-	2	2	1
8	ELC	U24IN408	Web Technologies Laboratory	-	-	2	2	1
9	VAC	U24IN409	Database Management Systems Laboratory	-	-	2	2	1
10	AEC	U24IN410	Python Programming for IoT Laboratory	-	-	2	2	1
11	VAC*	U24CH411*	Environmental Science*	2*	-	-		-
			Total:	14	5	8	25	21
Summer/ Inter-semBridge Courses (Approved by BoS and Dean,AA): 1 week to 10 days: 1 credit to each Bridge course under additional learning (will be printed on grade sheet)				NIL				

**For Lateral Entry Students Only*

*** Branch Specific Mathematics:**

Branch Specific Mathematics (Pool-4)			
S. No.	Course Code	Course Title	Common to
1.	U24MH401A	Numerical and Statistical Methods	CE
2.	U24MH401B	Applied Mathematics for Mechanical Engineering	ME
3.	U24MH401C	Applied Mathematics	EEE, ECE, ECI
4.	U24MH401D	Discrete Mathematics and Probability, Statistics	CSE, IT,CSN,CSO
5.	U24MH401E	Essential Mathematics and Statistics for Machine learning	CSM
6.	U24MH401F	Essential Mathematics and Statistics for Data science	CSD
7.	U24MH401X	Any other Course approved by BoS chair and Dean AA	-

@ Dean AA will allot the courses QALR (Stream-I), Soft and Interpersonal Skills (Stream-II), to the branches as per Stream-I and Stream-II.

Courses for exit:

Successful completion of two subjects (6-Credits)during2-months internship at the institute
OR
Successful completion of two suitable skill based courses (external) to qualify for Certification

B. After Second Year: (UG Diploma in CSE(IOT))

(i) The candidate should pass any two of the following additional courses (Diploma Level) during the 2-Months internship at institute

Exit Options to Qualify for UG Diploma in CSE(IOT): Any Two (02) Courses during the 2 - Months internship									
S. No.	Category	Course Code	Course Title	L	T	P	O	E	C
1	PCC	U24IN412X	Fundamentals of Algorithms	2	-	2	-	4	3
2	PCC	U24IN413X	Machine Learning for IoT	2	-	2	-	4	3
3	PCC	U24IN414X	Fundamentals of DevOps	2	-	2	-	4	3

(OR)

(ii) Any two suitable skill based courses to qualify for Diploma.

Exit Options to Qualify for UG Diploma in CSE(IOT): Any Two (02) Skill based Courses -:									
S. No.	Category	Course Code	Course Title	L	T	P	O	E	C
1	SEC	U24SE412X	Drone Pilot Reference: https://agnipathvayu.cdac.in	-	-	6	-	6	3
2	SEC	U24SE413X	CISCO: Switching Routing and Wirelss Essentials Reference: Offered by CISCO CoE, KITSW	-	-	6	-	6	3
3	SEC	U24SE414X	Graphic Design Reference: https://trainings.internshala.com/graphic-design-course	-	-	6	-	6	3
4	SEC	U24SE415X	Andrioid App Development Reference: https://trainings.internshala.com/android-course/	-	-	6	-	6	3

B. Tech Honours with Research:

Students opting for B. Tech Honours with Research, shall undergo a 2-Month Mandatory Research Internship-I (5 Credits)at respective department during the summer vacation after IV Semester.

DISCRETE MATHEMATICS AND PROBABILITY STATISTICS			
Class: B.Tech. IV -Semester		**Branch:**Common to CSE, CSN, CSO & IT	
Course Code:	**U24MH401D**	**Credits:**	**3**
Hours/Week (L-T-P-E):	**2-1-0-3**	**CIE:**	**60 %**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40 %**

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1 apply fundamentals of logic to solve various engineering problems

CO2 solve different types of enumeration problems and apply them to real-life

CO3 solve various graph theory problems and apply them to real-world applications

CO4 interpret the data using various statistical measures and probability distributions

.

UNIT-I	9 Hrs

Foundation: Sets and operations on sets, Relations, Binary relations, Equivalence relations, Partial order relations, Hasee diagram and lattices, Digraphs, Adjacency matrices of binary relations

Fundamentals of Logic: Propositions and connectives, Truth tables, Propositional functions, Logical inferences, First order logic, Predicate calculus and quantified logic

Application: Transitive closure of a relationusing Warshal'salgorithm

Self-Learning Topics (SLTs):*Monoids, Groups.(Ref 2: topic 3.2), Pigeonhole principle (Text 1: topic 1.7, problems1.7.13(2, 3, 4)), Mathematical Induction (Text 1: topic 1.10, problems 1.10.1, 1.10.3, 1.10.6)*

UNIT-II	9 Hrs

Elementary Combinatorics and Recurrence Relations: Basic concepts of permutations and combinations, Enumeration with unlimited repetition and applications, Enumeration with constrained repetitions and applications

Generating function of sequences: Coefficients of generating function, Recurrence relations and its applications, Solutions of recurrence relations by method of substitution, Characteristic roots, Solving non-linear recurrence relations

Application: Using recurrence relations find the computational complexity of binary search, Towers of Hanoi problem, and Sorting

Self-Learning Topics (SLTs):

Solutions of recurrence relations by generating function method(Text 1, topic:3.4, problems: 3.4.4, 3.4.5)

Additional problems on recurrence relations (Text 1, topics:3.5 and 3.6, problems:3.5.5, 3.5.6, 3.6.6, 3.6.8, 3.6.10)

UNIT-III	9 Hrs

Graphs:

Basic concepts, Isomorphism, Sub graphs, Trees and their properties, Spanning trees, Binary trees, Planner graphs, Euler's formula, Multi graphs and Eulerian circuits, Hamiltonian graphs, Chromatic number, Four color problem

Applications: Find the shortest path of a network problem

Self-Learning Topics (SLTs): *Additional problems on* isomorphism *of two graphs (Text 1, topic:5.2, problems:5.2.3, 5.2.4, 5.2.5)*

UNIT-IV	9 Hrs

Statistics: Statistical data, Review of measures of central tendency and measures of dispersion, correlation coefficient, rank correlation, regression – Linear regression equations.

Curve Fitting: Method of least squares –fitting of (i) Straight line (ii) Second degree parabola

Probability: Random variables, Discrete and continuous probability distributions, mean and variance of a distribution, Binomial distribution, Poisson distribution, and fitting of these probability distributions to the given data.

Self-Learning Topics (SLTs):

Review of the concepts of probability (Text2, topic:26.4 and 26.5, problems:26.15, 26.20, 26.25), Conditional probability and Bayes theorem (Text 2, topic:26.6, problems: 26.26, 26.27), Normal distribution (Text 2, topic:26.16, problems:26.45, 26.47, 26.48), Uniform, exponential distributions (Text 2, topic:26.19)

Textbook(s):

1. Mott. J.L,Kandel. K and, Baker. T.P., *Discrete Mathematics for Computer Scientists*, 2nd ed., New Delhi: PHI,1999
2. Grewal, B.S.,*Higher Engineering Mathematics*, 43rd ed., New Delhi: Khanna Publishers, 2017

Reference Book(s):

1. S.C. Gupta V.K. Kapoor, *Fundamentals of Mathematical Statistics*, 12th ed., New Delhi: Sultan Chand & Sons Educational Publishers, 2020
2. Jean-Paul Tremblay, Manohar R, *Discrete Mathematical Structures with Applications to Computer Science*, 1st ed., New York: McGraw-Hill, 1975.
3. Zohar Manna., *Mathematical Theory of Computation*,1st ed., New York: McGraw-Hill, 1974
4. C. L. Liu, *Elements of Discrete mathematics*, 3rd ed., New Delhi:Tata Mc. Graw Hill, 2008

Web and Video link(s):

1. https://onlinecourses.nptel.ac.in/noc25_cs26/course: *NPTEL Video Lecture on Discrete Mathematics by Prof. Sudarshan Iyengar, IIT Ropar*
2. https://onlinecourses.nptel.ac.in/noc25_ma33/preview?user_email=dsreddy.hari@gmail.com: *NPTEL Video Lecture on Introduction to Probability Theory and Statistics by Prof. S Dharmaraja, IIT Delhi*

Course Articulation Matrix (CAM):		**U24MH401D: DISCRETE MATHEMATICS AND PROBABILITY STATISTICS**												
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	**U24MH401.1**	2	2	1	1	-	-	-	1	1	-	1	2	1
CO2	**U24MH401.2**	2	2	1	1	-	-	-	1	1	-	1	2	1
CO3	**U24MH401.3**	2	2	1	1	-	-	-	1	1	-	1	2	1
CO4	**U24MH401.4**	2	2	1	1	-	-	-	1	1	-	1	2	1
U24MH401		**2**	**2**	**1**	**1**	**-**	**-**	**-**	**1**	**1**	**-**	**1**	**2**	**1**

CO–SDG Alignment Matrix				
CO	**Course Outcome**	**SDG**	**SDG Title**	**Mapping Justification**
CO1	apply fundamentals of logic to solve various engineering problems	**SDG 4**	Quality Education	Develops logical reasoning and analytical skills essential for engineering education and lifelong learning
CO2	solve different types of enumeration problems and apply them to real-life scenarios	**SDG 4**	Quality Education	Enhances mathematical thinking and problem-solving skills through practical applications
CO3	solve various graph theory problems and apply them to real-world applications	**SDG 9**	Industry Innovation and Infrastructure	Graph theory supports the design of efficient networks intelligent systems and innovative engineering solutions
CO4	interpret the data using various statistical measures and probability distributions	**SDG 4**	Quality Education	Develops data analysis and statistical reasoning skills required for informed decision making and engineering practice

WEB TECHNOLOGIES			
Class: B.Tech. IV–Semester		**Branch:** CSE (IoT)	
Course Code:	**U24IN402**	**Credits**	**3**
Hours/Week(L-T-P--E):	**2-1-0-3**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1 : design static web pages using HTML Tags

CO2 : design dynamic web pages using CSS and JavaScript

CO3 : devlop webserver-side applications using PHP concepts

CO4 : analyze enterprise databases for web-based applications using PHP and MySQL

UNIT-I	9 Hrs

Hypertext Markup Language (HTML):HTML Document structure, Basic tags, creating headings, working with links, creatingparagraphs, Working with images, Tables

Introduction to Forms and Controls: creating HTML form, specifying action URL and method to send the form, Using HTML controls

Cascadingstylesheet(CSS):CSSrulesandproperties,Types-inline,Externalandinternalstyle sheets, Style classes

UNIT-II	9 Hrs

JavaScript: Java Script syntax, Embedding Java Scripting HTML page, Usage of variables, working with operators, Control – flow statements, Arrays, Creating objects, Handling event

jQuery: Introduction to jQuery, jQuery selectors and filters jQuery events,DO Mmanipulation, Effect andanimations, jQuery and AJAX (Asynchronous java Scriptand XML) Bootstrap, Introduction to bootstrap & jQuery, Bootstrap basics, Bootstrap components, Bootstrap components with jQuery interactions, jQuery + AJAX (with bootstrap UI)

UNIT-III	9 Hrs

Introduction to Hypertext pre-processor (PHP) :PHP Overview of PHP, Creating and running a PHP script, handling errors, working with variables and constants variables, Datatypes and operators, Working with functions, Files and directories

Working with Forms: Submitting the form, Retrieving the form, Validating a web form, File upload

UNIT-IV	9 Hrs

Database using PHP: PHP &MySQL Integration basics, CRUD (create, read, update and delete) operations with PHP and MySQL.

Node.js: Introductiontonode.js,Buildingwithexpress.js,CRUDoperations,REST(representational state transfer)API development

Textbook(s):

1. Kogent, *Web Technologies HTML, CSS, JavaScript, ASP.NET, Servlets, JSP, PHP, ADO.NET, JDBC and XML*, 1st ed., New Delhi: Dream tech Press (Black Book), 2013. (Chapters 2, 3, 4, 5, 6, 7, 8, 12, 13)
2. RaghuRama KrishnanandJohannesGehrke, *Database Management Systems*, McGraw-Hill Education, 3rd edition 2002.

Reference Book(s):

1. I. Bayross, *Web Enabled Commercial Application Development Using HTML, JavaScript, DHTML and PHP*, 4th ed. New Delhi: BPB Publications, 2009.
2. U. K. Roy, *Web Technologies*, 7th ed. New Delhi: Oxford Higher Education, 2010.
3. N. Biswas, *Ultimate Full-Stack Web Development with MERN: Design, Build, Test and Deploy Production-Grade Web Applications with MongoDB, Express, React and NodeJS*, 1st ed. AVA Publisher, 2021.

Web and Video link(s):

https://onlinecourses.swayam2.ac.in/aic20_sp15/previewNPTEL *Video Lecture onJoomla CMS By Prof Kannan Moudgalya - Principal Investigator of Spoken Tutorial Project |Indian Institute of Technology Bombay*

Course Articulation Matrix (CAM):		U24IN402 WEB TECHNOLOGIES												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24IN402.1	3	2	2	-	3	-	-	1	1	-	1	3	2
CO2	U24IN402.2	3	2	2	-	3	-	-	1	1	-	1	3	2
CO3	U24IN402.3	3	2	3	2	3	-	-	1	1	-	1	3	3
CO4	U24IN402.4	3	2	3	2	3	-	-	1	1	-	1	3	3
U24IN402		3	2	2.25	1	2.9	-	-	1	1	-	1	3	3
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	design and develop static web pages using html tags and basic webpage structure.	SDG 4	Quality Education	Helps students gain foundational digital literacy and web development skills for lifelong learning.
CO2	create dynamic and responsive web pages using css and javascript for interactive user interfaces.	SDG 9	Industry, Innovation and Infrastructure	Promotes innovation in modern web technologies and development of user-friendly digital solutions.
CO3	develop web server-side applications using php concepts for processing user requests and business logic.	SDG 8	Decent Work and Economic Growth	Enhances employability skills in backend programming and supports career opportunities in software industries.
CO4	build and manage enterprise databases for web-based applications using php and mysql.	SDG 9	Industry, Innovation and Infrastructure	Strengthens knowledge in database systems and enterprise application development for scalable infrastructure.

DATABASE MANAGEMENT SYSTEMS			
Class: B.Tech. IV –Semester		**Branch:** CSE(IoT)	
Course Code:	**U24IN403**	**Credits:**	**4**
Hours/Week (L-T-P-E):	**2-1-0-3**	**CIE:**	**60 %**
Total Number of Teaching Hours:	**32 Hrs**	**ESE:**	**40 %**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1: designthe databases using entity relationship model

CO2: apply queries to manage the data that can efficiently store and retrieve

CO3: apply normalization techniques to reduce redundancy

CO4: apply locking techniques for concurrent transactions to recover the database failures

UNIT-I	**9 Hrs**

Databases and Database Users: Introduction, Characteristics of the database approach, Actors on the scene, Workers behind the scene, Advantages of using a DBMS, When not to use a DBMS

Database System Concepts and Architecture: Data models, Schemas and instances, Three-schema architecture and data independence, Database languages and interfaces, Classification of database management systems

Data Modeling using the Entity-Relationship(ER) Model: High-level conceptual data models for database design, Entity types, Entity sets, Attributes and keys, Relationships types, Relationship sets, Roles and structural constraints, Weak entity types, ER diagrams

Self Learning Topics (SLTs): *The database system environment (Text1: Topic2.4),The Enhanced Entity–Relationship (EER) Model (Text1: chapter 8)*

UNIT-II	**9 Hrs**

The Relational Data Model, Relational Database Constraints: Relational model concepts, Relational constraints and the Relational database schemas, Update operations and dealing with constraint violations

Basic Structured Query Language (SQL): SQL Data definition and data types, Specifying constraints in SQL, Basic retrieval queries in SQL,INSERT, DELETE, and UPDATE Statements in SQL

Relational Database Design by ER-to-Relational Mapping: Relational database design using ER-to-Relational mapping, EER-to-Relational mapping

Self Learning Topics (SLTs):Additional features of SQL *(Text1: Topic4.5)*, No SQL databases *(Text1: chapter 24.1)*

UNIT-III	**9 Hrs**

The Relational Algebra and Relational Calculus: Basic relational algebra operations, Examples of queries in relational algebra, The tuple relational calculus

Database Design Theory and Normalization: Informal design guidelines for relation schemas, Functional dependencies, Normal forms based on primary keys, General definitions of second and third normal forms, Boyce-Codd normal form, Algorithms for relational database schema design

Query Processing and Optimization: Translating SQL queries into relational algebra, Using heuristics in query optimization

Self Learning Topics (SLTs): *Domain relational calculus (Text1: Topic6.7), Multivalued dependency and fourth normal form(Text1: Topic15.6), Join dependencies and fifth normal form(Text1: Topic15.7)*

UNIT-IV	**9 Hrs**

Introduction to Transaction Processing Concepts and Theory: Introduction to transaction

processing, Transaction and system concepts, Desirable properties of transactions, Characterizing Schedules Based on Serializability

Concurrency Control Techniques: Two-PhaseLocking techniques for concurrency control, Concurrency control based on Timestamp Ordering

Database Recovery Techniques: Recovery concepts, NO-UNDO/REDO Recovery Based on deferred update, Recovery techniques based on immediate update, Shadow paging.

Self Learning Topics (SLTs): *Database Security and Authorization: Discretionary access control based on granting and revoking privileges, Mandatory Access Control and RoleBased Access Control for Multilevel Security(Text1: chapter 24)*

Textbook:

1. Ramez Elmasri and Shamkanth B. Navathe, *Fundamentals of Database Systems*, Pearson Education, 6th ed., 2010

Reference Book(s):

1. Raghu Ramakrishnan andJohannes Gehrke, *Database Management Systems*, McGraw-Hill Education, 3rded., 2002
2. Abraham Silberschatz, Henry F.Korth and S.Sudarshan, *Database System Concepts*, McGraw-Hill Education, 3rded., 1997
3. Thomas Connolly and Carolyn Begg, *Database Systems*, Pearson Education, 3rded., 2003

Web and Video link:

https://onlinecourses.nptel.ac.in/noc22_cs91/previewNPTEL *Video Lecture:Data Base Management System by Prof. Partha Pratim Das, Prof. Samiran Chattopadhyay, IIT Kharagpur*

Course Articulation Matrix (CAM):		**U24IN403: DATABASE MANAGEMENT SYSTEMS**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24IN403.1**	2	1	2	1	-	-	-	1	1	-	1	2	1
CO2	**U24IN403.2**	2	1	2	1	-	-	-	1	1	-	1	2	1
CO3	**U24IN403.3**	2	1	2	2	-	-	-	1	1	-	1	2	1
CO4	**U24IN403.4**	2	1	1	1	-	-	-	1	1	-	1	1	1
U24IN403		**1.87**	**1**	**1.75**	**1.2**	**1**	**-**	**-**	**1**	**1**	**-**	**1**	**1.75**	**1.12**

CO–SDG Alignment Matrix				
CO	**CO Statement** ***The student should be able to…***	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	design the databases using entity relationship model	SDG 9	Industry Innovation and Infrastructure	Develops efficient database designs that support reliable digital systems and modern information infrastructure
CO2	apply queries to manage the data that can efficiently store and retrieve	SDG 9	Industry Innovation and Infrastructure	Enables efficient data management and retrieval for scalable and intelligent software applications
CO3	apply normalization techniques to reduce redundancy	SDG 9	Industry Innovation and Infrastructure	Improves database efficiency consistency and resource utilization for sustainable information systems
CO4	apply locking techniques for concurrent transactions to recover the database failures	SDG 9	Industry Innovation and Infrastructure	Ensures reliable secure and fault tolerant database systems for robust digital infrastructure

IOT ARCHITECTURE AND PROTOCOLS			
Class: B.Tech IV –Semester		**Branch:** CSE (IoT)	
Course Code:	**U24IN404**	**Credits:**	**3**
Hours/Week (L-T-P-E):	**2-1-0-3**	**CIE:**	**60 %**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40 %**

Course Learning Outcomes (COs):

After completion of this course, the students should be able to,

CO1:analyze various IoT networks architecture and connectivity technologies

CO2:examine various IoT communication protocols for wireless device

CO3:interpret data protocols and discovery protocols in real-world scenarios

CO4:analyze infrastructure and semantic protocols for IoT

UNIT-I	**9 Hrs**

IoT Network Architecture and Design: Drivers behind new network architectures, OneM2M IoT standardized architecture, IoT World Forum (IoTWF) standardized architecture, A Simplified IoT architecture,Core IoT Functional stack, IoT data management and compute stack

IoT Connectivity Technologies: IEEE 802.15.4- 802.15 standards, Architecture, Topology, Addressing modes and Packet structure, Security, Zigbee-Overview, Physical layer and Media Access Control(MAC) Layer, Protocol stack, Addressing modes and packet structure, Topology, Security

Self Learning Topics (SLT): *Datalink layer addressing and Network layer addressing (Text: chapter 1.4)*

UNIT-II	**9 Hrs**

IoT Connectivity Technologies: Long Range (LoRa),Physical layer, Media Access Control(MAC) layer and topology, Z-Wave, Thread, ISA100.11A, RFID, NFC, NB-IoT, Wi-Fi, Bluetooth

IoT Communication Technologies: Constrained nodes, Constrained networks, Types of constrained devices, Low power and lossy networks

Self Learning Topics (SLT):*Weightless(Text1: chapter 7.11)*

UNIT-III	**9 Hrs**

Data Protocols: Message Queue Telemetry Transport(MQTT)-Publish-Subscribe Architecture, Packet structure and communication format, Message Queue Telemetry Transport -Sensor Networks (MQTT-SN)-Architecture, Topology, Constrained Application Protocol(COAP) – Architecture, Message formats, Advanced Message Queuing Protocol(AMQP), Extensible Messaging and Presence Protocol(XMPP), Simple Object Access Protocol(SOAP), Representational State Transfer(REST), Websocket

Discovery protocols: Physical web, Multicast DNS (mDNS), Universal plug and play(UPnP)

Self Learning Topics (SLTs):*Identification protocols(Text1:Chapter 8.5)*

UNIT-IV	**9 Hrs**

Infrastructure Protocols : Internet Protocols version6(IPv6), Lightweight On-demand Ad- hoc

distance vector Routing protocol – Next Generation(LOADng), Routing Protocols for Low-power(RPL), IPv6 over Low-Power Wireless Personal Area Networks(6LoWPAN), Quick UDP Internet Connections (QUIC), Micro Internet protocols(uIp), Nano Internet Protocols (NanoIP), Content-Centric Networking(CCN)

Semantic Protocols: JavaScript Object Notation for Linked Data (JSON-LD), Web of things model(WoT)

Self Learning Topics (SLT):*Device Management (Text1:Chapter 8.6)*

Textbook(s):

1. Sudip Misra, Anandarup Mukherjee , Arljit Roy, *Introduction to IoT* , New Delhi Cambridge University Press , 2020
2. David Hanes, Ganzalo Salgueiro,Patrick Grossetete Robert Barton,Jerome Henry, IoT Fundamentals networking Technolgies Protocols and use case of Internet of things,Indian polis Cisco press,2017

Reference Book(s):

1. Jeeva Jose,Internet of Things, New Delhi, Khanna, Publishing, 2018
2. Kamal RAJ, Internet,of Things,-Architecture and Design Principles, New Delhi
3. ManyurRamgir,Internet of Things-Architecture and Implementation and Security New Delhi Pearson Education, 2019

Web and Video link:

https://onlinecourses.nptel.ac.in/noc25_cs44/preview

Course Learning Outcomes (COs):

After completion of this course, the students should be able to,

CO1:analyze various IoT networks architecture and connectivity technologies

CO2:examine various IoT communication protocols for wireless device

CO3:interpret data protocols and discovery protocols in real-world scenarios

CO4:analyze infrastructure and semantic protocols for IoT

Course Articulation Matrix(CAM):		**U24IN404: IOT ARCHITECTURE AND PROTOCOLS**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24IN404.1**	2	2	2	1	1	-	-	1	1	-	1	2	2
CO2	**U24IN404.2**	2	2	2	1	1	-	-	1	1	-	1	2	2
CO3	**U24IN404.3**	2	2	2	1	1	-	-	1	1	-	1	2	2
CO4	**U24IN404.4**	2	2	2	1	1	-	-	1	1	-	1	2	2
U24IN404		2	2	2	1	1	-	-	1	1	-	1	2	2

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	analyze various IoT networks architecture and connectivity technologies	**SDG 9**	Industry Innovation and Infrastructure	develops knowledge of IoT network architectures that support smart and resilient digital infrastructure
CO2	examine various IoT communication protocols for wireless device	**SDG 9**	Industry Innovation and Infrastructure	enables efficient and reliable wireless communication for innovative IoT applications and connected systems
CO3	interpret data protocols and discovery protocols in real-world scenarios	**SDG 9**	Industry Innovation and Infrastructure	promotes effective data exchange and interoperability for scalable and intelligent IoT solutions
CO4	analyze infrastructure and semantic protocols for IoT	**SDG 9**	Industry Innovation and Infrastructure	supports the development of interoperable secure and sustainable IoT infrastructure for smart applications

PYTHON PROGRAMMING FOR IOT			
Class: B.Tech. IV -Semester		**Branch:**CSE (oT)	
Course Code:	**U24IN405**	**Credits:**	**3**
Hours/Week (L-T-P-E):	**2-1-0-3**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs):

After completion of this course, the students should be able to,

CO1:develop solutions to real-world problems by utilizing core Python programming constructs such as variables, operators, control statements, functions, and modules

CO2:analyse data by collecting, processing, and visualizing it using Python data structures, NumPy, Pandas, andMatplotlib

CO3: implement regular expressions to process data and interface a Raspberry Pi with sensors and actuators to build basic IoT applications

CO4:connect Raspberry Pi with other cloud platforms for data storage and visualization, and implement basic IoT data security practices

UNIT-I	**9 Hrs**

Python Programming: Introduction, Literal,Constants,Variables and identifiers, Data types, Input operation,Comments, Reserved words, Operators, Expressions in python, Type conversion, Decision control statements, Loops, Arrays

Functions: Function definition, Function call, Variable scope and lifetime, return statement, Decorator functions, Lambda functions, Recursive functions, String handling functions

Modules and Name Spaces:from…import statement, Naming module, Packages in python, Standard library modules, globals(), locals(), and reload(), Function redefinition

Self-Learning Topics (SLTs):*More on Functions, String handling functions, and operations (Textbook1: Chapters- 6,7, & 8*)

UNIT-II	**9 Hrs**

Data Collection: Lists, Tuple, Sets, Dictionaries, and Sequences

Numpy: Importance of NumPy and installation, NumPy arrays Vs. Python lists, Creating arrays, Basic Array operations

Pandas: Pandas objects, Data indexing and selection, Handling missing data, Combining datasets, Merge and join, Aggregation and grouping

Matplotlib:Importing Matplotlib, Saving figures to files, Line plots, Scatter plots, Histograms, Pie chart, Bar charts, 3D plots

Self-Learning Topics (SLTs):*More on numpy, pandas, matplotlib, plotting data (Text book1: Chapters-10,11,&12)*

UNIT-III	**9 Hrs**

Regular Expression: Introduction, Patterns and syntax, Regex functions in python, Groups and substitutions, Non -capturing groups, Greedy vs non greedy matching

Raspberry Pi:components**,** Features, Installation of Rasbarian operating system, Essential packages of python for IoT,Interfacing camera with Pi, Interfacing display with Pi, Integrating of sensor and actuators

Pi with Cloud: Introduction, Cloud service models, Cloud deployment models, Cloud providers (AWS, Azure, GCP)

Self Learning Topics (SLTs):*More on Lookahead and lookbehind, greedy vs non greedy, Linux related Commands, cloud platforms (Text book1: Chapters-11, Text book2: Chapters- 12)*

UNIT-IV	**9 Hrs**

Integration of Cloud & Pi:Connecting Pi to the Internet, Setting up API keys for cloud services, Sending and receiving data from pi to cloud, Stores sensor data in cloud, Data visualization on Thinkspeak cloud

Security in cloud- IoT integration: Securing data transmission (SSL/TLS, SSH keys), Device authentication in cloud platform

Case study: Weather forecasting

Self-Learning Topics (SLTs):*Cloud Accounts, how cloud receive the data from RPi (Text book2: Chapters-7,8)*

Textbook(s):

1. ReemaThareja, *Python Programming using problem solving approach,* New Delhi, 2nd ed., Oxford University Press, 2021. (Chapter 1 to 7)
2. Rajesh Singh, Anitha Gehlot, Bhupendra Singh, *Internet of Things with Raspberry Pi andArduino,*1st ed., CRC Press, 2019

Reference Book(s):

1. Simon Monk*Programming the Raspberry Pi*, 1st ed., McGraw-Hill/Tab Electronics
2. Simon Monk *Raspberry Pi Cookbook*,4th ed., O'Reilly Media
3. Derek Molloy *Exploring Raspberry Pi*, Wiley, 2016
4. Prof. Sudip Misra,Anandarup Mukherjee, Arijit Roy*Introduction to IoT* , Cambridge University Press, 2021

Web and Video link(s):

https://onlinecourses.nptel.ac.in/noc20_ee98/*NPTEL Video Lecture on Introduction to Internet of Things* by **Prof. Sudip Misra** from **IIT Kharagpur**

https://core-electronics.com.au/courses/raspberry-pi-workshop-for-beginners *Video Lecture on Raspberry Pi Workshop for Beginners* by Core Electronics

Course Articulation Matrix (CAM): U24IN405 PYTHON PROGRAMMING FOR IOT														
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	U24IN405.1	1	1	1	1	2	-	-	1	1	-	1	2	1
CO2	U24IN405.2	1	1	2	1	2	-	-	1	1	-	1	2	1
CO3	U24IN405.3	2	2	2	2	3	-	-	1	1	-	1	2	2
CO4	U24IN405.4	2	2	2	2	3	-	-	1	1	-	1	2	2
U24IN405		1.75	1.75	1.87	1.75	2.5	-	-	1.5	1	-	1	2	1.75

CO–SDG Alignment Matrix				
CO	**CO Statement** ***The student should be able to…***	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	develop solutions to real-world problems by utilizing core Python programming constructs such as variables operators control statements functions and modules	**SDG 4**	Quality Education	Develops programming and computational thinking skills required to solve real world engineering problems
CO2	analyse data by collecting processing and visualizing it using Python data structures NumPy Pandas and Matplotlib	**SDG 9**	Industry Innovation and Infrastructure	Enables data driven decision making through data analytics and visualization for innovative software applications
CO3	implement regular expressions to process data and interface a Raspberry Pi with sensors and actuators to build basic IoT applications	**SDG 9**	Industry Innovation and Infrastructure	Promotes the development of smart iot systems through embedded computing and automation technologies
CO4	connect Raspberry Pi with cloud platforms for data storage and visualization and implement basic IoT data security practices	**SDG 9**	Industry Innovation and Infrastructure	Supports secure cloud enabled iot solutions and resilient digital infrastructure for smart applications

QUANTITATIVE APTITUDE AND LOGICAL REASONING			
Class: B.Tech. IV -Semester		**Branch:** Common to all Branches	
Course Code:	**U24VA406A**	**Credits:**	**2**
Hours/Week (L-T-P-E):	**2-0-0-2**	**CIE**	**60 %**
Total Number of Teaching Hours:	**24 Hrs**	**ESE**	**40 %**

Course Learning Outcomes (COs):

After completion of this course, the students should be able to…

CO1: apply arithmetic concepts such as averages, percentages, ratios, and time-based calculations to solve real-life quantitative problems

CO2: analyze and solve problems involving financial, arithmetic and probability using structured quantitative methods

CO3: identify patterns and apply deductive reasoning to solve series, coding-decoding, and arrangement-based logical problems

CO4: evaluate logical statements, assess validity, and draw conclusions using tools like syllogisms, Venn diagrams, and argument analysis

UNIT-I	**6 Hrs**
Quantitative Aptitude-I: Number system, Averages, Percentages, Ratios & proportions, Time, Speed & distance, Time and work	
UNIT-II	**6 Hrs**
Quantitative Aptitude-II: Simple interest, Compound interest, Profit & loss, Ages, Permutations & Combinations, Probability	
UNIT-III	**6 Hrs**
Logical Reasoning-I: Series completion, Analogy, Coding and decoding, Blood relations, Number, Ranking & Time sequence test, Linear & Circular arrangements	
UNIT-IV	**6 Hrs**
Logical Reasoning-II: Data sufficiency, Logical Venn diagram, Syllogisms, Statement & Arguments, Statement & Assumptions, Direction sense test	

Note: Students should go through the QALR course supplementary material made available on online learning platform

- *Contents covered in class shall be practiced through the material available on the online learning platform. At home practice problems and practice tests shall be made available on the online learning platform*
- *Tutorial classes shall be conducted on the online learning platform and hence students shall attend the tutorial classes with laptop/tab*
- *All assessments shall be conducted through online learning platform*

Textbook(s):

1. **R S Agarwal**, *Quantitative Aptitude for Competitive Examinations*, 3rd ed., New Delhi: S. Chand Publications, 2019. *(Chapters 1,6,7,8,10,11,12,15,17,21,22,30,31 - for Unit I & II)*
2. **R S Agarwal**, *A Modern Approach to Verbal and Non-Verbal Reasoning*, 3rd ed., New Delhi: S. Chand Publications, 2019. *(Chapters Section I: 1,3,4,5,6,8,16, Section II: 2,3 - for Unit III & IV)*

Reference Book(s):

1. **Dinesh Khattar**, *Quantitative Aptitude for Competitive Examinations*, 1st ed., New Delhi: Pearson India, 2019.
2. **Nishit K Sinha**, *Reasoning for Competitive Examinations*, 1 st ed., New Delhi: Pearson India,

2019.
3. **R. N. Thakur**, *General Intelligence and Reasoning*, 1st ed., New Delhi: McGraw Hill Education, 2017.

Course Articulation Matrix (CAM):		**U24VA406:A QUANTITATIVE APTITUDE AND LOGICAL REASONING**											
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	**U24VA406A .1**	1	2	-	1	-	-	-	-	-	-	1	1	-
CO2	**U24VA406A.2**	1	2	-	1	-	-	-	-	-	-	1	1	-
CO3	**U24VA406A.3**	-	1	-	2	-	2	-	-	-	-	1	1	-
CO4	**U24VA406A.4**	-	1	-	2	-	2	-	-	-	-	1	1	-
U24VA406A		**1**	**1.5**	**-**	**1.5**	**-**	**2**	**-**	**-**	**-**	**-**	**1**	**1**	**-**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

PROGRAMMING SKILL DEVELOPMENT LAB-3			
Class: B.Tech. IV–Semester		**Branch:**CSE(Internet of Things**)**	
Course Code:	**U24SE407**	**Credits:**	**1**
Hours/Week (L-T-P-E):	**0-0-2-2**	**CIE:**	**100%**
Total Number of Lab Hours:	**36 Hrs**	**ESE:**	**-**

Course Learning Outcomes (COs):

After completion of this course, the students should be able to …

CO1: implement programs on operators and control structures.

CO2: develop programs using arrays, strings, exception handling and multithreading

CO3: build programs using binary trees, binary search trees.

CO4:develop programs using spanning trees, searching, sorting.

LABORATORY COMPONENT

SI.NO	List of Experiments
1	Implementation of operators and data types using java.
2	Implementation of control statements using java.
3	Implementation of loops using java.
4	Implementation of simple arrays and strings using java.
5	Implementation of arrays and strings using java.
6	Implementation of functions and recursion using java.
7	Implementation of exceptions using java.
8	Implementation of multithreading using java.
9	Implementation of binary tree using java.
10	Implementation of binary search tree using java.
11	Implementation of spanning tree using java.
12	Implementation of searching and sorting using java.

Textbook(s):

1. Herbert Schildt, *Java The Complete Reference*, 9th ed.,New Delhi: McGraw-Hill Education India Pvt. Ltd, 2014
2. Debasis Samanta, *Classic Data Structures*, 2nd ed., New Delhi: Prentice Hall India, 2009 (Chapters 3 to 8, 10, 11)

Reference Book(s):

1. Kathy Sierra and Bert Bates, *Head First Java,* 2nd ed.,Boston: O'Reilly Publications, 2013
2. Uttam K. Roy, *Advanced JAVA Programming*, 1st ed.England: Oxford Publication, 2013
3. Balaguruswamy ,*Programming with Java : A Primer* ,6th ed., New Delhi: McGraw-Hill Education India Pvt. Ltd, 2019
4. Tanweer Alam ,*Internet and Java Programming*,1st ed.,New Delhi: Khanna Publishing House,2010
5. Reema Thareja, *Data Structures Using C*, 2nd ed., Noida: Oxford University Press, 2014
6. E Balagurusamy, *Data Structure Using C*, 1st ed. New Delhi: McGraw Hill Education, 2017
7. Richard F. Gilberg and Behrouz A. Forouzan, *Data Structures: A Pseudo code Approach with C*, 2nd ed., Noida: Cengage Learning, 2007
8. Yashavant P. Kanetkar, *Data Structure Through C*, 2nd ed., New Delhi: BPB Publications, 2003

Course Articulation Matrix (CAM):		U24SE407: PROGRAMMING SKILL DEVELOPMENT LAB-3												
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24SE407.1	1	1	1	1	-	-	-	1	1	-	1	1	2
CO2	U24SE407.2	2	2	2	1	-	-	-	1	1	-	1	1	2
CO3	U24SE407.3	2	2	2	1	-	-	-	1	1	-	1	1	2
CO4	U24SE407.4	2	2	2	1	-	-	-	1	1	-	1	1	2
U24SE407		**1.75**	**1.75**	**1.75**	**1**	**-**	**-**	**-**	**1**	**1**	**-**	**1**	**1**	**2**

WEB TECHNOLOGIES LABORATORY			
Class: B. Tech. IV–Semester		**Branch:**CSE (IoT)	
Course Code:	**U24IN408**	**Credits:**	**1**
Hours/Week (L-T-P- E):	**0-0-2-2**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1 : Create thestatic webpagesusingHTMLTags

CO2 : DesigndynamicwebpageforwebapplicationsusingCSSandJavaScript

CO3 : Developserver-sidescriptsforwebbaseapplicationsusingPHP

CO4 : design web applications for effective storage and retrieval of datain MySQL using PHP

Experiment-1 (UNIT-I)

1. Design an HTML page to display all heading tags (<h1> to <h6>) with suitable examples.
2. Create an HTML page to insert and display images with different sizes, borders, and alternate text.
3. Design an HTML table to display student marks with rows, columns, headings, rows pan, and colspan.
4. Write an HTML program to create an ordered list, unordered list, and nested list.
5. Create a simple web page combining headings, paragraphs, images, links, and tables.

Experiment-2 (UNIT-I)

1. Design an HTML form for student registration with text box, password, radio button, checkbox, and submit button.
2. Develop a login form using username, password, and submit/reset buttons.
3. Design an online application form using various HTML controls such as dropdown list, textarea, file upload, and date picker.

Experiment-3 (UNIT-I)

1. Write a program to apply inline CSS styles to headings and paragraphs.
2. Create a web page using internal CSS to style text colour, background colour, font size, and alignment.
3. Develop a web page using external CSS file to style multiple HTML pages.
4. Write a CSS program to apply hover effects on links and buttons.

Experiment-4 (UNIT-II)

1. Write a JavaScript program to declare variables using var, let, and cost and display their values.

2. Develop a JavaScript program to perform arithmetic, relational, logical, and assignment operations.
3. Write a JavaScript program to demonstrate if, if-else, nested if, switch, and looping statements.
4. Create a JavaScript program to find the largest of three numbers using control flow statements.

Experiment-5 (UNIT-II)

1. Develop a JavaScript program to search an element in an array and display the result.
2. Write a JavaScript program to declare variables using var, let, and const and display their values.
3. Develop a JavaScript program to perform arithmetic, relational, logical, and assignment operations.
4. Write a JavaScript program to demonstrate if, if-else, nested if, switch, and looping statements.
5. Create a JavaScript program to find the largest of three numbers using control flow statements.

Experiment-6 (UNIT-II)

1. Develop a jQuery program to change CSS properties dynamically using DOM manipulation.
2. Write a jQuery program to append, prepend, remove, and replace HTML elements.
3. Create a jQuery program to demonstrate effects such as hide(), show(), fade In(), fadeout(), slide Up(), slide Down().
4. Develop a jQuery program to submit form data asynchronously using AJAX.
5. Create a responsive login page using Bootstrap and jQuery validation.

Experiment-7 (UNIT-III)

1. Write a PHP program to display "Hello World" and explain the basic structure of a PHP script.
2. Create a PHP program to create, read, write, append, and delete files in a directory.
3. Develop a PHP script to list all files and folders available in a given directory.
4. Write a PHP program to demonstrate different data types such as integer, float, string, Boolean and array.
5. Develop a PHP program using user-defined functions to calculate the factorial of a number.

Experiment-8 (UNIT-III)

1. Design an HTML form and write a PHP program to submit and retrieve form data

using GET and POST methods.

2. Create a PHP program to validate a registration form with fields like name, email, password, and mobile number.
3. Write a PHP script to validate user inputs using server-side validation techniques.

Experiment-9 (UNIT-III)

1. Develop a PHP application to upload an image or document file and store it in the server directory.
2. Create a PHP script to handle file upload errors and display proper error messages.
3. Build a mini project using PHP forms to collect student details, validate inputs, and store data in a file.

Experiment-10 (UNIT-IV)

1. Write a PHP program to establish a connection with a MySQL database and display a success message.
2. Create a PHP application to insert student records into a MySQL database table.
3. Develop a PHP script to retrieve and display all records from a database table in tabular format.
4. Write a PHP program to update employee details in a MySQL database using PHP.
5. Create a PHP application to delete a record from a MySQL table using PHP.

Experiment-11 (UNIT-IV)

1. Develop a complete CRUD application using PHP and MySQL for managing student information.
2. Write a PHP script to search records in a MySQL database using user input.
3. Create a PHP program to implement login authentication using PHP and MySQL database.
4. Develop a PHP script to upload student details through a web form and store them in MySQL database.
5. Create a PHP mini project for Library Management System using PHP and MySQL with CRUD operations.

Experiment-12 (UNIT-IV)

1. Write a Node.js program to display Hello World and explain the basic structure of Node.js.
2. Create a Node.js application using Express.js to start a web server.
3. Develop an Express.js application to create routes for Home, About, and Contact pages.
4. Create a REST API using Node.js and Express.js to insert data into a database.

5. Develop a REST API to retrieve all records from a database using GET method.
6. Write a Node.js REST API to update records using PUT method.
7. Create a REST API to delete records using DELETE method.
8. Develop a complete Student Management System API using Node.js, Express.js, and MySQL/MongoDB.
9. Build a mini project for Employee Management REST API with CRUD operations using Express.js.

Textbook(s):

1. Kogent,*Web Technologies HTML,CSS, JavaScript, ASP.NET, Servlets, JSP, PHP, ADO.NET, JDBC and XML*, 1st ed., New Delhi: Dream tech Press (Black Book), 2013. (Chapters 2, 3, 4, 5, 6, 7, 8, 12, 13)
2. Raghu Rama Krishnan and JohannesGehrke, *Database Management Systems*, McGraw-Hill Education, 3rd edition 2002.

Reference Book(S):

1. Bayross, *Web Enabled Commercial Application Development Using HTML, JavaScript, DHTML and PHP*, 4th ed. New Delhi: BPB Publications, 2009.
2. U. K. Roy, *Web Technologies*, 7th ed. New Delhi: Oxford Higher Education, 2010.
3. N. Biswas, *Ultimate Full-Stack Web Development with MERN: Design, Build, Test and Deploy Production-Grade Web Applications with Mongo, Express, React and NodeJS*, 1st ed. AVA Publisher, 2021.

Web and Video link(s): https://onlinecourses.nptel.ac.in/noc22_ee116/preview, *NPTEL Video Lecture on Dital Image Processing by Prof. Prabir Kumar Biaswas, Professor of EEE, IIT Kharagpur.*

Laboratory Manual (for laboratory component):

1. *Computer Vision and Image Processing Laboratory Manual,* Department of CSE (AI & ML), KITSW

Course Articulation Matrix (CAM):		U24IN408: WEB TECHNOLOGIES LABORATORY												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24IN408.1	3	2	-	-	2	-	-	1	1	-	1	3	2
CO2	U24IN408.2	3	2	2	-	3	-	-	1	1	-	1	3	2
CO3	U24IN408.3	3	2	3	2	3	-	-	1	1	-	1	3	2
CO4	U24IN408.4	3	2	3	2	3	-	-	1	1	-	1	3	3
U24IN408		3	2	2.25	1	2.9	-	-	1	1	-	1	3	2.5
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement (The student should be able to…)**	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	create static web pages using html tags	SDG 4	Quality Education	Develops foundational web development skills and digital literacy essential for technical education and software development
CO2	design dynamic web pages for web applications using css and javascript	SDG 9	Industry, Innovation and Infrastructure	Enhances front-end web development skills for creating interactive and user-friendly web applications used in modern industries
CO3	develop server-side scripts for web-based applications using php	SDG 9	Industry, Innovation and Infrastructure	Builds competencies in server-side programming for developing scalable and efficient web applications supporting digital innovation
CO4	design web applications for effective storage and retrieval of data in mysql using php	SDG 16	Peace, Justice and Strong Institutions	Promotes secure and reliable web applications through efficient database management, supporting data integrity and trustworthy information systems

DATABASE MNAGEMENT SYSTEMS LABORATORY			
Class: B. Tech. IV – Semester		**Branch:** CSE(IoT)	
Course Code:	**U24IN409**	**Credits:**	**1**
Hours/Week (L-T-P- E):	**0-0-2-2**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1: design entity relationship diagrams, implement SQL queries to create and manipulate data in Database by enforcing constraints

CO2 : implement various database objects using SQL Queries

CO3: implementblock structuredprogramming withcursorsto enable traversalover the records of the database redundancy and maintain the performance of database

CO4: implement pre-compiled stored programs, run-time errors checking, database objects Collection in PL/SQL high-level security using triggers

Experiment-1

Design Entity relationship diagrams of a database.

Experiment-2

Write a SQL Queries on Data definition language (DDL), Data manipulation Language (DML), Transaction control language (TCL) and Data control language (DCL) commands.

Experiment-3

Write SQL Queries on column level and table level constraints.

Experiment-4

Write SQL Queries using built-in functions of NUMBER, CHARACTER, DATE datatypes.

Experiment-5

Write SQL Queries on single row functions and operators and aggregate functions.

Experiment-6

Write a SQL Queries on joins and nested queries.

Experiment-7

Write SQL statements to create simple, composite indexes, user defined data types, views, sequences.

Experiment-8

Write sample PL/SQL programs using conditional and iterative statements

Experiment-9

Write PL/SQL programs using cursors and parameterized cursors.

Experiment-10

Write PL/SQL programs to handle exceptions.

Experiment-11

Write PL/SQL programs using stored procedures and functions.

Experiment-12

Write PL/SQL programs for creating Triggers.

Reference Book(S):

4. Bayross, I. (2010). *SQL, PL/SQL: The Programming Language of Oracle* (4th ed.). New Delhi: BPB Publications.
5. Deshpande, P. S. (2011). *SQL & PL/SQL for Oracle 11g Black Book*. New Delhi: Wiley Publisher.

Web and Video link(s):

https://onlinecourses.nptel.ac.in/noc22_ee116/preview, *NPTEL Video Lecture on Dital Image Processing by Prof. Prabir Kumar Biaswas, Professor of EEE, IIT Kharagpur.*

Laboratory Manual (for laboratory component):

1. *DatabaseManagement Systems LaboratoryManual and Record Book,* Department of CSE(Networks), KITSW

Course Articulation Matrix (CAM):		U24IN409 : Database Management System Laboratory												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24IN409.1	2	1	2	1	1	-	-	1	1	-	1	2	1
CO2	U24IN409.2	2	1	2	1	1	-	-	1	1	-	1	2	1
CO3	U24IN409.3	1	1	1	1	1	-	-	1	1	-	1	1	1
CO4	U24IN409.4	2	1	2	1	1	-	-	1	1	-	1	2	2
U24IN409		1.75	1	1.75	1	1	-	-	1	1	-	1	1.75	1.25
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement (The student should be able to…)**	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	Design Entity Relationship (ER) diagrams and implement SQL queries to create and manipulate data in databases by enforcing constraints	SDG 4	Quality Education	Develops database design, logical thinking, and SQL programming skills that strengthen core computing competencies
CO2	Implement various database objects using SQL queries	SDG 9	Industry, Innovation and Infrastructure	Enhances database development skills required for building reliable information systems used in industrial and enterprise applications
CO3	Implement block-structured programming with cursors to enable traversal over database records, reduce redundancy, and maintain database performance	SDG 9	Industry, Innovation and Infrastructure	Promotes efficient database management techniques that improve system performance, scalability, and data integrity in modern applications
CO4	Implement block-structured programming with cursors to enable traversal over database records, reduce redundancy, and maintain database performance	SDG 9	Industry, Innovation and Infrastructure	Promotes efficient database management techniques that improve system performance, scalability, and data integrity in modern applications

PYTHON PROGRAMMING FOR IoT LABORATORY			
Class: B. Tech. IV – Semester		**Branch:** CSE (IoT)	
Course Code:	**U24IN410**	**Credits:**	**1**
Hours/Week (L-T-P- E):	**0-0-2-2**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1: develop and test Python programs using basic data types, decision control structures, loops, functions, and string operations

CO2: implement data structures and perform numerical and data analysis using NumPy and Pandas

CO3: Utilize visualize data using Matplotlib and regular expressions, Raspberry Pi GPIO, and sensors for basic data acquisition and image

CO4: integrate IoT devices with cloud platforms for data transmission, remote device control, and rea Time monitoring applications

Experiment-1 (UNIT-I)
1.Python program to demonstrate datatypes,operators,input and output functions.
Experiment-2 (UNIT-I)
1.Python program to demonstrate control statements and loops .
Experiment-3 (UNIT-I)
1.Python program to demonstrate functions,lambda functions and decorators.
Experiment-4 (UNIT-II)
1.Python program to demonstrate list,tuple,and dictionary.
Experiment-5 (UNIT-II)
1.Python program to demonstrate numpy library.
Experiment-6 (UNIT-II)
1.Python program to demonstrate pandas .
Experiment-7 (UNIT-III)
1.Python program to demonstrate matplot libraries.
Experiment-8 (UNIT-III)
1.Python program to demonstrate regular expression.
Experiment-9 (UNIT-III)
1. Demonstrate installation of Raspbian OS on Pi,connecting LED and DHTsensor.
Experiment-10 (UNIT-IV)
1.Demonstrate integration of cloud and Pi with suitable examples.
Experiment-11 (UNIT-IV)
1.Demonstrate setting up connection between Blynk app on a mobile device and control an LED.
Experiment-12 (UNIT-IV)
1.Greenhouse Monitoring System by Integrate multiple sensors(temperature,humidity,soilmoisture) and send data to the cloud for real-time monitoring.

Textbook(s):

1. Reema Thareja, *Python Programming Using Problem Solving Approach*, Oxford University Press, 2nd edition, 2021, New Delhi. (Chapt
2. ers 1 to 7)
3. Rajesh Singh, Anitha Gehlot, Bhupendra Singh, *Internet of Things with Raspberry Pi and Arduino*, CRC Press, 1st edition, 2019. (Chapters 1 to 3)

Reference Book(S):

1. Simon Monk, *Programming the Raspberry Pi*, McGraw-Hill/Tab Electronics, 1st edition. (Chapters 1 to 3)
2. Simon Monk, *Raspberry Pi Cookbook*, O'Reilly Media, 4th edition. (Chapters 1 to 3)
3. Derek Molloy, *Exploring Raspberry Pi*, Wiley, 2016. (Chapters 1 to 3)
4. Prof. Sudip Misra, Anandarup Mukherjee, Arijit Roy, *Introduction to IoT*, Cambridge University Press, 2021. (Chapters 1 to 3)

Laboratory Manual (for laboratory component):

1. *Python programming for IoT Laboratory Manual,* Department of CSE (NETWORKS), KITSW

Course Articulation Matrix (CAM):		U24IN410 : PYTHON PROGRAMMING FOR IOT LABORATORY												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24IN410.1	2	2	2	2	2	-	-	2	1	-	1	2	2
CO2	U24IN410.2	2	2	2	2	2	-	-	2	1	-	1	2	2
CO3	U24IN410.3	2	2	2	2	3	-	-	2	1	-	1	2	2
CO4	U24IN410.4	2	2	2	2	3	-	-	2	1	-	1	2	2
U24IN410		2	2	2	2	2.5	-	-	2	1	-	1	2	2
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement (The student should be able to…)**	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	develop and test python programs using basic data types, decision control structures, loops, functions, and string operations	SDG 4	Quality Education	Develops programming proficiency, computational thinking, and problem-solving
CO2	implement data structures and perform numerical and data analysis using numpy and pandas	SDG 9	Industry, Innovation and Infrastructure	Equips students with data analysis and computational skills that support innovation, intelligent systems, and industrial applications
CO3	utilize data visualization using matplotlib and regular expressions, raspberry pi gpio, and sensors for basic data acquisition and image processing	SDG 9	Industry, Innovation and Infrastructure	Promotes the use of embedded systems, data visualization, and sensor-based technologies for developing innovative engineering solutions
CO4	integrate iot devices with cloud platforms for data transmission, remote device control, and real-time monitoring applications	SDG 11	Sustainable Cities and Communities	Enables the development of smart IoT-based monitoring and automation systems that improve resource management, infrastructure, and smart city applications

ENVIRONMENTAL STUDIES			
Class:B.Tech.IV Semester		**Branch:** Commonto all branches	
CourseCode:	**U24CH411**	**Credits:**	**0**
Hours/Week(L-T-P-E):	**2-0-0-2**	**CIE:**	**60%**
TotalNumberofTeachingHours:	**24Hrs**	**ESE:**	**40%**

CourseLearningOutcomes(COs):

Aftercompletionofthiscourse,thestudentsshouldbeableto,

CO1: identifythe naturalresources and practice their usage more equitably

CO2:developanactionplanforsustainablealternativesandconserving biodiversity

CO3:examine and perceive the solutions for the environmental pollution

CO4:adapt issues involved in enforcement of environmental legislation andgreen methodology

UNIT-I	**6Hrs**

The Multidisciplinary Nature of Environmental Studies: Definition, Scope and importance

Natural Resources: Forest Resources-Use and over exploitation of forests, Deforestation, Timber extraction, Mining, Dams and their effects on forests and tribal people**,** Water Resources-Use and over-utilization of surface and ground water, Floods, Drought, Conflicts over water**,** Mineral Resources-Environmental effects of extracting and using mineral resources**,** Energy Resources-Renewable and non-renewable energy sources, Use of alternate energy sources

Self Learning Topics (SLTs): *Use and over-utilization of surface and ground water (Text1: unit 2, topic: 2.2.2) world food problems (Text1: unit 2, topic 2.2.2)*

UNIT-II	**6Hrs**

Ecosystem and Biodiversity:

Ecosystem: Concepts of an ecosystem, Food chain, Food webs, Ecological pyramids, Energy flow in the ecosystem and ecological succession

Biodiversity and its Conservation: Introduction, Definition, Genetic, Species and ecosystem diversity, Value of biodiversity, Biodiversity in India, Hot spots of biodiversity, Man-wildlife conflicts, Endangered and endemic species of India, In-situ and Ex-situ conservation

Self Learning Topics (SLTs): *Introduction and definition of biodiversity (Text1: unit 4, topic 4.1)*

UNIT-III	**6Hrs**

Environmental Pollution: Global issues**-**Global climatic change, Greenhouse gases, Effects of global warming, Ozone layer depletion

International Conventions/Protocols: Earth summit, Kyoto protocol, Montreal protocol **Environmental Pollution-**Causes and effects of air, Water, Soil, Marine and noise pollution with case studies

Solid and Hazardous Waste Management: Introduction, Types, Effects of urban industrial and nuclear waste

Natural Disaster Management: Introduction to disaster, Management of disaster, Disaster management of flood, earthquake, cyclone and landslides

Role of information technology in environment and human health

Self Learning Topics (SLTs): *Role of individual in prevention of pollution (Text1: unit 5, topic 5.10)*

UNIT-IV	6Hrs

Social Issues and the Environment: Role of Individual and Society, Water conservation, Rain water harvesting

Environmental Protection/Control Acts: Air (prevention and control of pollution) act 1981, Forest conservation act (1980 and 1992), Wildlife protection act 1972, Environment protection act 1986, Issues involved in enforcement of environmental legislations

Green Methodology: Principles of green chemistry, Green methods in electronic production, Impact of electronic waste on public health and environment

The Sustainable Development Goals (SDGs): United Nations Sustainable Development Goals

SelfLearningTopics(SLTs):*Water (prevention and control of pollution) act 1974(Text1: unit 6, topics 6.10), Water pollution cess act 1977(Text1: unit 6, topics 6.11)*

Textbook(s):

1. ErachBharucha,*TextBook of EnvironmentalStudies for UnderGraduateCourses,* 2nd Edn.,UniversitiesPress(India)Pvt.Ltd,2013

ReferenceBook(s):

1. Y. Anjaneyulu, *Introduction to Environmental Science*, B.S. Publications, 2004.
2. Gilbert M. Masters, *Introduction to Environmental Engineering & Science*, 3rd Edn., Prentice Hall of India,1991
3. Anubha Kaushik, C.P. Kaushik, *Environmental Studies*, 4th Edn., New Age International Publishers,2014
4. R. Rajagopalan, *Environmental Studies from crisis to cure*, Oxford University Press, 2nd Edn., 2011

Weband Videolink(s):

1. https://archive.nptel.ac.in/noc/courses/noc22/SEM1/noc22-ch27/ *videolecture on renewable energy resources by Prof. Vaibhav. V. Goud and Dr. R. Anandalakshmi, Dept. Of Chemical Engineering, Guwahati.*
2. https://sdgs.un.org/goals, UN's webpage on 17 sustainable Development Goals
3. **https://onlinecourses.nptel.ac.in/noc23_hs57/preview**United nations Sustainable Development Goals

CourseLearningOutcomes(COs):

Aftercompletionofthiscourse,thestudentsshouldbeableto,

CO1: identifythe naturalresources and practice their usage more equitably
CO2:developanactionplanforsustainablealternativesandconserving biodiversity
CO3:examine and perceive the solutions for the environmental pollution
CO4:adapt issues involved in enforcement of environmental legislation andgreen methodology

CourseArticulationMatrix(CAM):		U24CH411ENVIRONMENTAL STUDIES												
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	**U24CH411.1**	2	1	2	1	-	2	1	1	1	-	-	-	-
CO2	**U24CH411.2**	-	-	2	-	-	1	1	1	1	1	-	-	-
CO3	**U24CH411.3**	1	2	1	-	-	1	1	1	1	1	1	-	-
CO4	**U24CH411.4**	-	-	1	-	-	1	1	1	1	-	1	-	-
U24CH411		**1.50**	**1.50**	**1.50**	**1.00**	**-**	**1.25**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**-**	**-**

CO–SDG Alignment Matrix				
CO	**CO Statement (The student should be able to…)**	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	identify natural resources and practice their equitable and sustainable utilization	SDG 12	Responsible Consumption and Production	Promotes the sustainable and equitable use of natural resources, encouraging responsible consumption and conservation practices
CO2	develop action plans for sustainable alternatives and biodiversity conservation	SDG 15	Life on Land	Focuses on biodiversity conservation, ecosystem protection, and sustainable management of terrestrial resources
CO3	examine environmental pollution issues and evaluate appropriate mitigation and control measures	SDG 13	Climate Action	Encourages understanding of pollution control and environmental protection to combat climate change and its impact
CO4	analyze issues related to the enforcement of environmental legislation and adopt green methodologies for sustainable development	SDG 16	Peace, Justice and Strong Institutions	Highlights the role of environmental laws, governance, and policy implementation in achieving sustainable development through green practices

FUNDAMENTALS OF ALGORITHMS			
Class: B.Tech. IV–Semester (Exit Course)		**Branch:** CSE (Internet of Things)	
Course Code:	**U24IN412X**	**Credits:**	**3**
Hours/Week (L-T-P-O-E):	**2-0-2-0-4**	**CIE:**	**60 %**
Total Number of Teaching Hours:	**32Hrs**	**ESE:**	**40 %**

Course Learning Outcomes (COs):

After completion of this course, the students should be able to,

- **CO1:** illustrate the concepts of algorithms and its complexity
- **CO2:** apply mathematical concepts to derive the time complexity of algorithms
- **CO3:** applyrecursive and iterative algorithms for basic data structures
- **CO4:** analyze problems by applying suitable approaches
- **CO5:** implement basic data structures and time complexity
- **CO6:** develop optimized algorithms for sorting techniques
- **CO7:** develop graph algorithms for efficient searching and deriving time complexity
- **CO8:** build andcompare recursive and iterative algorithms

THEORY COMPONENT	
UNIT-I	**4 Hrs**
Introduction: Algorithm definition, Mathematical notations, Contradiction, Mathematical induction **Elementary Algorithms:** The efficiency of algorithms, Elementary operations and example algorithms	
UNIT-II	**4 Hrs**
Asymptotic Notations: Big oh, Omega, Theta, Little Oh, Little Omega notations, Problems on asymptotic notations **Analysis of Algorithms:** Analysing control structures, Solving recurrences and problems on analysis of algorithms	
UNIT-III	**4 Hrs**
Some data Structures: Arrays, stacks and queues, records and pointers, lists, graphs, Trees, Associative tables, Heaps, Binomial heaps, Disjoint sets **Divide and Conquer:** Binary Search, Sorting, Finding the median, Matrix Multiplication	
UNIT-IV	**4 Hrs**
Greedy Method: General characteristics, Minimum spanning trees, shortest path algorithm, Knapsack problem **Dynamic Programming:** Principle of optimality, 0/1 knapsack problem, shortest path algorithm using dynamic approach, DFS and BFS	
LABORATORY COMPONENT	

List of Experiments

1. Write a program to implement:
   a. A Queue
   b. A Stack
   c. A Queue using two Stacks.
   d. A Stack using two Queues
2. Write an algorithm and find the efficiency of the same for following problems:
   a. Finding Factorial – Iterative Approach
   b. Finding Factorial – Recursive Approach
   c. Printing Fibonacci Series – Iterative Approach
   d. Printing Fibonacci Series – Recursive Approach
3. Design an algorithm and implement a program for Selection Sort
4. Design an algorithm and implement a program for:
   a. Linear search
   b. Count sort
5. Design an algorithm and implement a program for:
   a. Merge Sort
   b. Binary Search
6. Design an algorithm and implement a program to solve Knapsack Problem
7. Design an algorithm and implement a program to solve Longest Common Subsequence
8. Design an algorithm and write a program to implement:
   a. Depth First Search of a graph
   b. Breadth First Search of a graph
9. Design an algorithm and write a program to implement Breadth-First Search of a Graph
10. Design an algorithm and implement a program for:
    a. Kruskal's method of finding Minimum Spanning Tree
    b. Prim's method of finding Minimum Spanning Tree

Textbook(s):

1. Brassard, G., & Bratley, P. *Fundamentals of algorithmics*. Prentice-Hall: Inc., 1996

Reference Book(s):

1. Cormen, T. H., Leiserson, C. E., Rivest, R. L., & Stein, C. *Introduction to algorithms.* MIT press: 2022
2. Rajaraman, V., & Adabala, N. *Fundamentals of computers*. PHI Learning Pvt. Ltd2014

Web and Video link(s):

https://archive.nptel.ac.in/courses/106/105/106105157/
https://www.classcentral.com/course/swayam-fundamental-algorithms-design-and-analysis-58462

Laboratory Manual (for laboratory component): Fundamentals ofAlgorithms Laboratory*Manual and Record Book,* Department of CSE (Networks), KITSW

Course Articulation Matrix (CAM):		U24IN412X: FUNDAMENTALS OF ALGORITHMS												
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24IN412X.1	2	2	2	2	1	-	-	1	1	-	1	1	1
CO2	U24IN412X.2	2	2	2	2	1	-	-	1	1	-	1	1	1
CO3	U24IN412X.3	2	2	2	2	1	-	-	1	1	-	1	1	1
CO4	U24IN412X.4	2	2	2	2	1	-	-	1	1	-	1	1	1
CO5	U24IN412X.5	2	2	2	2	2	-	-	1	1	-	1	1	1
CO6	U24IN412X.6	2	2	2	2	2	-	-	1	1	-	1	1	1
CO7	U24IN412X.7	2	2	2	2	2	-	-	1	1	-	1	1	1
CO8	U24IN412X.8	2	2	2	2	2	-	-	1	1	-	1	1	1
U24IN412X		**2**	**2**	**2**	**2**	**1.5**	**-**	**-**	**1**	**1**	**-**	**1**	**1**	**1**

MACHINE LEARNING FOR IOT			
Class: B.Tech. IV-Semester		**Branch:**CSE(IoT)	
Course Code:	**U24IN411X**	**Credits:**	**3**
Hours/Week (L-T-P-O-E):	**2-0-2-0-4**	**CIE Marks:**	**60%**
Total Number of Teaching Hours:	**32 Hrs**	**ESE Marks:**	**40%**

Course Learning Outcomes (COs):

After completion of this course, the students should be able to,

- **CO1:** analyze various data processing technologies in IoT applications
- **CO2:** analyze the data using data pre-processing techniques
- **CO3:** design and analyze IoT applications using supervised learning algorithms
- **CO4:** design and analyze IoT applications using unsupervised learning algorithms
- **CO5:** develop code for implementing fundamentals of python programming
- **CO6:** develop python code for implementing numpy, pandas, matplotlib libraries
- **CO7:** develop python code for implementing supervised learning algorithm used in IoT applications
- **CO8:** develop python code for implementing unsupervised learning algorithm used in IoT applications

UNIT-I	4 Hrs

Data Access and Distribution Processing For IoT: Data format, Importance of processing of IoT data, Processing topologies, IoT device design and selection considerations, Processing offloading, Data access and distributed processing for IoT, Role of AI in IoT

UNIT-II	4 Hrs

Data Pre-processing: Data cleaning -handling missing values, outliers; Feature engineering, Feature scaling -normalization, standardization; Label encoding, One-hot encoding, Train-test split, Cross-validation

UNIT-III	4 Hrs

Supervised Learning Algorithms: Linear regression, Logistic regression, K-Nearest Neighbors (KNN), Decision trees, Random forest, Naive Bayes(NB), Support Vector Machines (SVM)

UNIT-IV	4 Hrs

Unsupervised Learning: K-means,Hierarchicalclustering,DBSCAN

Dimensionality Reduction:Principal Component Analysis(PCA),t-SNE

List of Experiments

1. Installation of Python
2. Write a program to demonstrate importance of indentations. Purposefully raise indentation error and correct it
3. Write a program to find circulating ‘n’ values and module using import statement.
4. Write python program on file operations for the following
   a) To open and read data from a file
   b) To write data into a file

c) To compute number of characters, words, lines in a file

5. Demonstrate NumpyandPandas libraries
6. Demonstrate Matplot library
7. Demonstrate Linear regression and Multiple Linear regression algorithm with suitable dataset
8. Demonstrate Logistic regression algorithm with suitable dataset
9. Demonstrate KNN algorithm with suitable dataset
10. Demonstrate K-Means algorithm with suitable dataset

Textbook(s):

1. Stuart Russell and Peter Norvig, *Artificial Intelligence: A Modern Approach*, 3rd ed., New Delhi: Prentice Hall Series in AI, 2010
2. Stephen Marsland, Taylor & Francis, *Machine Learning: An Algorithmic Perspective*, CRC, ISBN -13: 978-1420067187, 2009

Reference Book(s):

1. Jason Bell,*Machine Learning: Hands-On for Developers and Technical Professionals*, John Wiley & Sons, 1st ed., ISBN-13: 978-1118889060, 2014
2. Elaine rich and Kevin knight, *Artificial Intelligence*, 2nd ed., New Delhi: Tata McGraw-Hill, 2002
3. William WHsieh, *Machine Learning Methods in the Environmental Sciences, Neural Networks*, Cambridge University Press, ISBN -13: 978-0805822410, 2009

Web and Video link(s):

#nptel #pythonprogramming #skumaredu ; *NPTEL Video Lecture on PROGRAMMING IN PYTHON by* Dr. Rizwan Rehman , *Assistant Professor of* Dibrugarh University

Laboratory Manual (for laboratory component):

Machine Learning for IoT Laboratory Manual, Dept. of CSE(N), KITSW

Course Articulation Matrix (CAM):		U24IN413X :MACHINE LEARNING FOR IOT												
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24IN413X.1	2	2	1	1	2	-	-	1	1	-	1	2	1
CO2	U24IN413X.2	2	2	2	1	2	-	-	1	1	-	1	2	1
CO3	U24IN413X.3	2	2	2	2	3	-	-	1	1	-	1	2	2
CO4	U24IN413X.4	2	2	2	2	3	-	-	1	1	-	1	2	2
CO5	U24IN413X.5	2	2	2	2	2	-	-	1	1	-	1	2	1
CO6	U24IN413X.6	2	2	2	2	2	-	-	1	1	-	1	2	1
CO7	U24IN413X.7	2	2	2	2	3	-	-	1	1	-	1	2	2
CO8	U24IN413X.8	2	2	2	2	3	-	-	1	1	-	1	2	2
U24IN413X		**2**	**2**	**1.87**	**1.75**	**2.5**	**-**	**-**	**1**	**1**	**-**	**1**	**2**	**1.5**

CO–SDG Alignment Matrix				
CO	**CO Statement The student should be able to...**	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	analyze devops principles, sdlc models, ci/cd concepts, and cloud computing service models.	**SDG 9**	Industry, Innovation and Infrastructure	Understanding DevOps, CI/CD, and cloud technologies enables the development of innovative, scalable, and efficient software infrastructure for modern industries.
CO2	apply linux command-line operations and write basic shell scripts to automate tasks.	**SDG 4**	Quality Education	Developing Linux administration and scripting skills enhances technical competency, practical learning, and employability in software engineering.
CO3	apply git for version control and configure jenkins to set up continuous integration and continuous deployment workflows.	**SDG 9**	Industry, Innovation and Infrastructure	Version control and CI/CD automation improve software quality, development efficiency, and support modern industrial software engineering practices.
CO4	implement containerization using docker and manage deployments with docker compose and kubernetes.	**SDG 9**	Industry, Innovation and Infrastructure	Containerization and orchestration technologies facilitate scalable, reliable, and cloud-native application deployment, supporting digital innovation and resilient infrastructure.
CO5	apply command-line tools to develop a linux environment and automate tasks.	**SDG 4**	Quality Education	Hands-on experience with Linux tools develops practical technical skills and promotes experiential learning aligned with industry requirements.
CO6	apply git and github to manage code versions and collaborate effectively with teams.	**SDG 17**	Partnerships for the Goals	Collaborative development using Git and GitHub fosters teamwork, knowledge sharing, and effective collaboration in software development projects.
CO7	apply jenkins to automate build and integration processes.	**SDG 9**	Industry, Innovation and Infrastructure	Automating software build and integration processes enhances productivity, software reliability, and innovation in DevOps environments.
CO8	implement docker and docker compose to containerize and orchestrate applications.	**SDG 9**	Industry, Innovation and Infrastructure	Deploying applications using Docker technologies supports efficient resource utilization, scalable infrastructure, and modern cloud-based software deployment.

FUNDAMENTALS OF DEVOPS			
Class: B.Tech. IV–Semester (Exit Course)		**Branch:**CSE (IoT)	
Course Code:	**U24IN414X**	**Credits:**	**3**
Hours/Week (L-T-P-O-E):	**2-0-2-0-4**	**CIE :**	**60 %**
Total Number of Teaching Hours:	**32Hrs**	**ESE :**	**40 %**

Course Learning Outcomes (COs):

After completion of this course, the students should be able to,

CO1 : analyze DevOps principles, SDLC models, CI/CD concepts, and Cloud Computing service models

CO2 : apply Linux command-line operations and write basic shell scripts to automate tasks

CO3 : apply Git for version control and configure Jenkins to set up Continuous Integration and Continuous Deployment workflows

CO4 : implement containerization using Docker and manage deployments with Docker Compose and Kubernetes

CO5 : apply command-line tools to develop a Linux environment and automate tasks

CO6 : apply Git and GitHub to manage code versions and collaborate effectively with teams

CO7 : apply Jenkins to automate build and integration processes

CO8 : implement Docker and Docker Compose to containerize and orchestrate applications

UNIT-I	4 Hrs

Introduction to DevOps: Getting started with DevOps**,**The evolution of the DevOps culture, Understanding Infrastructure-as-a code(IaC)practices

Introduction to Cloud Computing: Cloud Computing at a glance, Cloud computing architecture, Cloud platforms in industry

UNIT-II	4 Hrs

Linux Basics and Admin: Learning the shell, Navigation,Manipulatingfilesand directories, Working with commands, Permissions, Processes, Visualinterface(Vi)

Shell Scripting: Introduction to shell script, Variables and constants, Shell functions

UNIT-III	4 Hrs

Managing Your Source Code with Git: Overviewing Git and its principal command lines, Git installation, Git configuration, Useful Git vocabulary, Git command lines, Managing branches

Continuous Integration and Continuous Delivery(CI/CD): Installing and configuring Jenkins, Configuring a GitHub webhook, Configuring a Jenkins CI job, Creating a CI /CD pipelines

UNIT-IV	4 Hrs

Containerized Microservices with Docker and Kubernetes: Installing Docker, DockerHub, Creating a Dockerfile, Building and running a container on a local machine, Getting started with Docker Compose, Executing Docker Compose

Managing Containers Effectively with Kubernetes: Installing Kubernetes, Kubernetes architecture overview, Example of Kubernetes application deployment

List of Experiments

1. Install Ubuntu (or any Linux distro) on a Virtual Machine
2. Perform basic Linux file operations: create, delete, move, copy files and directories using terminal
3. Install Git and configure user details using git config
4. Create a local Git repository, perform commits, and manage branches
5. Install Jenkins on a local system or on AWS
6. Create a freestyle Jenkins project
7. Install Docker on Linux and verify usingdocker --version
8. Write a Dockerfile to containerize a simple Node.js or Python application
9. Build and run a custom Docker image locally
10. Use Docker Compose to run multi-container applications (e.g., web + DB)

Textbook(s):

1. **Mikael Krief,** *Learning DevOps Continuously Deliver Better Software*, 2nded., Mumbai: Birmingham, 2022
2. **RajkumarBuyya, ChristianVecchioa**, **S.ThamaraiSelvi***Mastering Cloud Computing Fou ndations and Applications Programming,*Australia: The University of Melbourne and Manjrasoft Pty Ltd, 2013
3. **William E. Shotts**, **Jr,** *The Linux Command Line: A Complete Introduction*, 2nd ed., San Francisco: 245 8th Street, 2019

Reference Book(s):

1.Gene Kim, Kevin Behr, and George Spafford, *The Phoenix Project*, 4th ed., 2024

2.Kelsey Hightower, Brendan Burns, and Joe Beda, *Kubernetes Up & Running,* 3rd ed., 2022

Web and Video link(s):

1. **https://learn.microsoft.com/en-us/devops/what-is-devops**
2. https://elearn.nptel.ac.in/shop/iit-workshops/completed/cicd-DevOps-automation-and-devsecops-automation/?v=c86ee0d9d7ed
3. https://www.simplilearn.com/learn-DevOps-basics-free-skillup

Laboratory Manual (for laboratory component): DevOps Laboratory*Manual and Record Book,* Department of CSE (Networks), KITSW

Course Articulation Matrix (CAM):		U24IN414X :FUNDAMENTALS OF DEVOPS												
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24IN414X.1	2	2	1	1	2	1	-	1	1	-	1	2	1
CO2	U24IN414X.2	2	2	2	1	2	1	-	1	1	-	1	2	1
CO3	U24IN414X.3	2	2	2	2	3	1	-	1	1	-	1	2	2
CO4	U24IN414X.4	2	2	2	2	3	1	-	1	1	-	1	2	2
CO5	U24IN414X.5	2	2	2	2	2	1	-	1	1	-	1	2	1
CO6	U24IN414X.6	2	2	2	2	2	1	-	1	1	-	1	2	1
CO7	U24IN414X.7	2	2	2	2	3	1	-	1	1	-	1	2	2
CO8	U24IN414X.8	2	2	2	2	3	1	-	1	1	-	1	2	2
U24IN414X		**2**	**2**	**1.87**	**1.75**	**2.5**	**1**	**-**	**1**	**1**	**-**	**1**	**2**	**1.5**

CO–SDG Alignment Matrix				
CO	**CO Statement** **The student should be able to...**	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	analyze DevOps principles, SDLC models, CI/CD concepts, and Cloud Computing service models	SDG 9	Industry, Innovation and Infrastructure	Understanding DevOps, CI/CD, and cloud computing supports modern software development, innovation, and digital infrastructure.
CO2	apply Linux command-line operations and write basic shell scripts to automate tasks	SDG 4	Quality Education	Developing Linux and shell scripting skills enhances technical competency and lifelong learning.
CO3	apply Git for version control and configure Jenkins to set up Continuous Integration and Continuous Deployment workflows	SDG 9	Industry, Innovation and Infrastructure	Applying Git and Jenkins improves software quality, automation, and efficient software delivery practices.
CO4	implement containerization using Docker and manage deployments with Docker Compose and Kubernetes	SDG 9	Industry, Innovation and Infrastructure	Containerization and orchestration technologies enable scalable, reliable, and efficient cloud-native applications.
CO5	apply command-line tools to develop a Linux environment and automate tasks	SDG 4	Quality Education	Practical Linux environment configuration and automation strengthen industry-relevant technical skills.
CO6	apply Git and GitHub to manage code versions and collaborate effectively with teams	SDG 17	Partnerships for the Goals	Git and GitHub promote collaboration, teamwork, and effective software development practices.
CO7	apply Jenkins to automate build and integration processes	SDG 9	Industry, Innovation and Infrastructure	CI automation using Jenkins enhances software engineering productivity and innovation.
CO8	implement Docker and Docker Compose to containerize and orchestrate applications	SDG 9	Industry, Innovation and Infrastructure	Docker and Docker Compose support efficient application deployment and modern cloud infrastructure.

V SEMESTER

S. No.	Category	Course Code	Course Title	Lectures / week				Credits
				L	T	P	E	C
1	OE	U24OE501X-SDGB	Open Elective –SDGB (Pool - XVI)	2	1	-	3	3
2	PCC	U24IN502	Artificial Internet of Things	2	1	-	3	3
3	PCC	U24IN503	Automata Theory and Compiler Design	2	1	-	3	3
4	PCC	U24IN504	Design and Analysis of Algorithms	2	1	-	3	3
5	PCC	U24IN505	Software Engineering	2	1	-	3	3
6	IKSC	U24IK506B	Essence of Indian Traditional Knowledge	2	-	-	2	2
7	SEC	U24IN507	Full Stack Development Laboratory	-	-	2	2	1
8	PCC	U24IN508	Artificial Internet of Things Laboratory	-	-	2	2	1
9	PCC	U24IN509	Design and Analysis of Algorithms Laboratory	-	-	2	2	1
10	ELC	U24IN510	Seminar			2	2	1
Total:				12	5	8	25	21

Pool - XVI Sustainable Development Goals Basket (OE - SDGB)		
S. No.	Course Code	Course Title
1.	U24OE501A-SD	Cloud Computing (Offered by CSE)
2.	U24OE501B-SD	AI Ethics (Offered by CSE (AI & ML))
3.	U24OE501C-SD	Sustainable AI (Offered by CSE (AI & ML))
4.	U24OE501D-SD	Any other course approved by BoS Chair and Dean AA

CLOUD COMPUTING			
Class: B. Tech. V- Semester		**Branch:** Common to All Branches	
Course Code:	**U24OEX17**	**Credits:**	**3**
Hours/Week (L-T-P- E):	**3-1-0-4**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1 : design enterprise-level applications in hosted cloud environments using Software as a Service (SaaS) model.

CO2 : analyze virtual cloud resources for deploying and executing applications using virtual machines.

CO3 : apply cloud service models such as SaaS, PaaS and IaaS using cloud platforms including Microsoft Azure, Google App Engine and Amazon Web Services.

CO4 : apply cloud economics, security mechanisms and resource management techniques to mitigate risks and support further study and research in cloud computing.

UNIT-I	9 Hrs

Principles of Parallel and Distributed Computing: Eras of computing, parallel vs distributed computing, elements of parallel computing, elements of distributed computing, technologies for distributed computing.

Introduction: Cloud computing at a glance, historical developments, building cloud computing environment, computing platforms and technologies.

UNIT-II	9 Hrs

Cloud Computing Architecture: Introduction, cloud reference model, types of cloud, economics of cloud, open challenges.

Virtualization: Introduction, characteristics of virtualized environments, taxonomy of virtualization techniques, virtualization and cloud computing, pros and cons of virtualization, technology examples.

UNIT-III	9 Hrs

Data Intensive Computing: Introduction, data intensive computing, technologies for data intensive computing.

Cloud Platform in Industry: Amazon Web Services, Google App Engine, Microsoft Azure.

Cloud Applications: Scientific applications - ECG analysis in the cloud, business and consumer applications - CRM and ERP.

UNIT-IV	9 Hrs

Advanced Topics in Cloud Computing: Federated clouds/InterCloud characterization and definition, cloud federation stack, aspects of interest, technologies for cloud federation.

Cloud Security: Security top concern for cloud users, cloud security risks, privacy and privacy impact assessment, trust, cloud data encryption, security of database services, operating system security, virtual machine security, security of virtualization, security risks posed by shared images, security risks posed by a management operating system, mobile devices and cloud security.

Textbook(s):

1. Rajkumar Buyya, Christian Vecchiola, Thamarai Selvi, *Mastering Cloud Computing,* McGraw Hill Education, 2nd edition, 2024, New Delhi.
2. Dan C. Marinescu, *Cloud Computing Theory and Practice,* Elsevier, 2nd edition, 2018, Cambridge.

(Chapter No. 1, 3, 7, 10)

Reference Book():

1. Thomas Erl and Eric Barceló Monroy, *Cloud Computing: Concepts, Technology, Security, and Architecture*, Pearson, 2nd Edition, 2024, Boston.
2. Dr. Kumar Saurabh, *Cloud Computing: Architecting Next-Gen Transformation Paradigms*, Wiley India Private Limited, 4th edition, 2018, New Delhi.

Web and Video link(s):

ttps://onlinecourses.nptel.ac.in/e-learning/preview/noc26_cs55

NPTEL Video Lecture on Cloud Computing by Prof. Soumya Kanti Ghosh, Professor of CSE, IIT Kharagpur.

Course Articulation Matrix (CAM):		U24OE501A-SD: CLOUD COMPUTING												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24OE501A-SD.1	2	2	2	1	2	-	-	1	-	1	-	2	2
CO2	U24OE501A-SD.2	2	2	2	1	2	-	-	1	-	1	-	2	2
CO3	U24OE501A-SD.3	2	2	2	2	2	1	1	1	1	1	1	2	2
CO4	U24OE501A-SD.4	2	2	2	2	2	1	1	1	1	1	1	2	2
U24OE501A-SD		**2**	**2**	**2**	**1.5**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**
3 – HIGH, 2 – MEDIUM, 1 – LOW														

CO	CO Statement The student should be able to...	Relevant SDG	SDG Description	Mapping Justification
CO1	design enterprise-level applications in hosted cloud environments using Software as a Service (SaaS) model	SDG9	Industry, Innovation and Infrastructure	SaaS-based enterprise applications support scalable digital infrastructure and promote innovation by enabling organizations to deploy cloud-hosted solutions efficiently.
CO2	analyze virtual cloud resources for deploying and executing applications using virtual machines	SDG9	Industry, Innovation and Infrastructure	Virtual machines and cloud resources form the foundation of modern IT infrastructure, enabling flexible, scalable and reliable application deployment.
CO3	apply cloud service models such as SaaS, PaaS and IaaS using cloud platforms including Microsoft Azure, Google App Engine and Amazon Web Services	SDG9	Industry, Innovation and Infrastructure	Cloud service models and platforms support digital transformation, improve productivity, create cloud-based innovation opportunities and contribute to employability.
CO4	apply cloud economics, security mechanisms and resource management techniques to mitigate risks and support further study and research in cloud computing	SDG8	Decent Work and Economic Growth	Cloud economics, security and resource management strengthen students' technical knowledge and research readiness, supporting lifelong learning and advanced study in cloud computing.

AI ETHICS			
Class: B.Tech. V-Semester		**Branch:** CSE(IoT)	
CourseCode:	**U24OE501B-SD**	**Credits:**	**3**
Hours/Week(L-T-P- E):	**2-1-0-3**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

- **CO1:** understand and apply the fundamental concepts of Artificial Intelligence to explain key ethical issues, ethical approaches, and the significance of AI ethics in modern society
- **CO2:** analyze ethical issues in Artificial Intelligence from the perspectives of policy, regulation, philosophy of technology, and real-world case studies
- **CO3:** apply ethical frameworks and methods in applied ethics to identify, interpret, and evaluate ethical challenges arising from AI systems
- **CO4:** analyze human values, intelligence, and human nature in the context of AI systems, and assess the boundaries between humans and intelligent machines

UNIT-I	9 Hrs

Introduction: What is Artificial Intelligence, Why AI Ethics is so exciting?, Bottom-Up and Top-Down approaches to AI Ethics, The boundaries and limitations of ethics, Developing ethical autonomy

The Rise of AI Ethics: Ethical questions in AI currently receiving attention, Same or different? What's special about AI Ethics? Common themes and varieties of questions in AI Ethics, Ethical questions in AI currently receiving attention

UNIT-II	9 Hrs

AIPolicy and Regulatory Standards: AI Ethics, Law,Policy, Regulation, Ethics guidance Case Study **-** An indigenous AI report

AI, Philosophy of Technology, and Ethics: Comparing AI to humans, Case Study - Attributing agency to humans and to AI, A brief introduction to the philosophy of technology, Technology and attitudes towards nature, The implicit values of technology, Communication through new technologies

UNIT-III	9 Hrs

Methods in Applied Ethics:A simple account of methods in Applied Ethics, The challenges from AI for methodology in Applied Ethics, Common assumptions about the nature of ethics and their influence on methodology in Applied Ethics

Methodology in Applied Ethics: The stories we tell, Introduction to ethical narratives in AI, Stories about AI systems

UNIT-IV	9 Hrs

Humans and Intelligent Machines– Underlying Values: The nature and value of intelligence, Values underlying the use of data

Human Nature : Self, Reason, Boundaries, Philosophical perspectives- The Divided Self and notions of the Higher Self, Reason or Emotion?, The boundaries of Human nature, Boundaries and limits, Is human nature Perfectible?, Myths and origin stories about

human nature
Textbook(s): 1. P.Boddington, *AI Ethics*, 1st edition, Cham, Switzerland: Springer International Publishing, 2017.(Chapter 1 to 5)
ReferenceBook(s): **1.** P.Boddington, Artificial Intelligence*: Foundations, Theory, and Algorithms*, Cham, Switzerland: Springer Nature, 2023 **2.** Stuart Russell and Peter Norvig, *Artificial Intelligence: A Modern Approach*, 4th edition, Hoboken, NJ, USA: Pearson, 2021
WebandVideo link(s): https://onlinecourses.nptel.ac.in/e-learning/preview/noc24_cs132, *NPTEL Video Lecture on* ***Responsible & Safe AI Systems*** *by Prof. Ponnurangam Kumaraguru, Prof.Balaraman Ravindran, Prof. Arun Rajkumar | IIIT Hyderabad, IIT Madras*

Course Articulation Matrix (CAM):		**U24OE501B-SD : AI ETHICS**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	U24OE501B-SD.1	2	2	2	2	1	1	1	1	1	-	2	2	1
CO2	U24OE501B-SD .2	2	2	3	2	1	1	1	1	1	-	2	3	1
CO3	U24OE501B-SD.3	2	2	2	2	1	1	1	1	1	-	2	3	1
CO4	U24OE501B-SD.4	2	2	3	3	1	1	1	1	1	-	2	3	1
U24OE501B		**2**	**2**	**2.5**	**2.25**	**1**	**1**	**1**	**1**	**1**	**-**	**2**	**2.75**	**1**
3–HIGH,2–MEDIUM,1–LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	understand and apply the fundamental concepts of artificial intelligence to explain key ethical issues, approaches, and the significance of AI ethics in modern society	SDG4	Quality Education	AI ethics improves critical thinking and awareness about responsible technology use, strengthening quality education and informed learning in emerging technologies
CO2	analyze ethical issues in AI through the perspectives of policy, regulation, philosophy of technology, and real-world case studies	SDG16	Peace, Justice and Strong Institutions	Studying AI governance, law, and policy supports ethical decision-making, transparency, and responsible institutional frameworks for trustworthy AI systems
CO3	apply ethical frameworks and methods in applied ethics to identify, interpret, and evaluate ethical challenges arising from AI systems	SDG9	Industry, Innovation and Infrastructure	Ethical analysis methods help design safer and more responsible AI systems, promoting innovation with accountability in technological development
CO4	analyze human values, intelligence, and human nature in the context of AI systems, and assess the boundaries between humans and intelligent machines	SDG3	Good Health and Well-being	Understanding human-centered AI and value alignment supports safer AI applications in healthcare, psychology, and human well-being systems

SUSTAINABLE AI			
Class: B.Tech. V-Semester		**Branch:** CSE(IoT)	
Course Code:	**U24OE501C-SD**	**Credits:**	**3**
Hours/Week(L-T-P- E):	**2-1-0-3**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1: analyze the role of sustainability and Artificial Intelligence, resource efficiency and consumption, and climate awareness in addressing environmental challenges

CO2: analyze the energy consumption and environmental impacts of artificial intelligence models

CO3: apply optimization techniques for resource-efficient deployment of artificial intelligence systems.

CO4: analyze sustainable Artificial Intelligence applications and emerging trends across various domains to identify their impacts, opportunities, and challenges

UNIT-I	9 Hrs

Sustainability and Artificial Intelligence: Scope of sustainability and sustainable development goals, Artificial intelligence- The new electricity?, Sustainability x AI, A green path to sustainable AI

Generative AI Foundations: Introduction to GenAI& representation Learning, Auto encoders, Large language models, Multimodal generative models and data modalities

Quantifying the Efficiency of Deep Learning: AI Waste, Resource Consumption of Deep Learning, Resource Efficiency and Climate Awareness, Carbon Footprint of AI, Estimating the Carbon Footprint of AI Models

UNIT-II	9 Hrs

Data Parsimony: The cost of data, Dataset curation, Active learning for dataset creation, Learning with pruned datasets, Learning with compressed data, Data and dataset compression

Automating Model Selection: Hyper parameter optimization, Neural architecture search, Model selection in the era of foundational models, Model selection automated

UNIT-III	9 Hrs

Training Efficiency: Training costs of AI models, Transfer learning, training compressed neural networks, Quantization, Efficient training techniques

Lean Inference: Lifetime cost of an AI model, Achieving lean inference, Deploying models, Lean and efficient inference

Hardware Considerations: Environmental cost of AI hardware, Hardware scaling laws of AI, The alchemy of creating AI, Improving the resource efficiency of AI hardware, Hardware optimization for sustainable AI

UNIT-IV	9 Hrs

A Recipe for Sustainable AI: Introduction and sustainability across the AI lifecycle, Technical debt of machine learning, Environmental debt of AI, Operationalizing sustainable AI, Green MLOps

Toward Sustainable AI: Rebound effects and AI, Economic sustainability of AI, Social sustainabilty of AI, Sustainable AI principles impact of sustainable AI

Textbook:

1. Raghavendra Selvan,"Sustainable AI Tools for Moving Toward Green AI", First Edition, O'Reilly Media, October 2025

ReferenceBook(s):

1. Aboul Ella Hassanien, Roheet Bhatnagar, and Ashraf, *Artificial Intelligence for Sustainable Development: Theory, Practice and Future Applications*, Springer Nature, Computational Intelligence, Volume 912, September 2021, New Delhi
2. Mohammad Dastbaz, Colin Pattinson, Babak Akhgar, *Green Information Technology A Sustainable Approach,* Morgan Kaufmann 1st Edition, March 3,2015

Web and Video link(s):

1. https://onlinecourses-archive.nptel.ac.in/noc18_ce08,*NPTEL VideoLecture on* ***Sustainable Engineering Concepts And Life Cycle Analysis*** *by Prof. Brajesh Kr. Dubey, , IIT Kharagpur*

Course Articulation Matrix (CAM):		U24OE501C: SUSTAINABLE AI												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24OE501C.1	1	2	1	1	1	-	1	1	1	1	1	1	1
CO2	U24OE501C.2	1	2	2	2	1	-	1	1	1	1	1	1	1
CO3	U24OE501C.3	1	2	2	2	1	-	1	1	2	1	1	1	1
CO4	U24OE501C.4	1	2	1	1	1	-	1	1	2	1	1	1	1
U24OE501C		**1**	**2**	**1.5**	**1.5**	**1**	**-**	**1**	**1**	**1.5**	**1**	**1**	**1**	**1**
3–HIGH,2–MEDIUM,1–LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	analyze the role of sustainability & AI, resource efficiency and consumption, and climate awareness in addressing environmental challenges	SDG4, SDG13	Quality Education, Climate Action	Provide the knowledge about the principles of bio inspired computing and natural intelligence to improve the quality of understanding and study by observing nature and derive the solutions
CO2	Analyze energy consumption and environmental impacts of AI models	SDG7, SDG9	Affordabl and Clean Energy, Industry, Innovation and Infrastructure	The algorithms developed can be used for helping the industry to improve the infrastructure by optimizing various situations with a large number of parameters
CO3	apply optimization techniques for resource-efficient AI deployment	SDG16	Peace, Justice and Strong Institutions	The solutions developed are useful in finding the Improved infrastructure in the smart city environment like self-driving cars with swarm intelligence solutions
CO4	analyze sustainable AI applications and emerging trends across various domains to identify their impacts, opportunities, and challenges	SDG11, SDG12, SDG13	Sustainable Cities and Communities, Responsible Consumption and Production, Climate Action	Smart applications like Smart Greenhouse improve sustainable agriculture

ARTIFICIAL INTERNET OF THINGS			
Class: B. Tech. V–Semester		**Branch:**CSE (IoT)	
Course Code:	**U24IN502**	**Credits:**	**3**
Hours/Week (L-T-P-E):	**2-1-0-3**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1 : apply IoT data processing, AI fundamentals, Intelligent agents, Search techniques, and game-playing algorithms to design intelligent IoT systems for real-world applications

CO2 : apply machine learning concepts, preprocessing methods, model development pipeline, and evaluation metrics to build and assess predictive models for real-world applications

CO3 : apply supervised and unsupervised machine learning techniques, including regression, classification, and clustering algorithms, to solve IoT-based data analysis problems

CO4 : demonstrate understanding of deep learning and generative AI concepts, including neural networks, CNNs, and LSTM models for IoT applications

UNIT-I	**9 Hrs**

Data access and distribution processing for IoT: Data format, Linear and non-linear data, Importance of processing of IoT, Processing topologies, IoT device design and selection considerations, Processing offloading, Data access and distributed processing, Role of AI in IoT

Artificial Intelligence (AI): Definition, Intelligent agents, Problem-solving algorithms, Heuristic searching, Game-playing algorithms

UNIT-II	**9 Hrs**

Machine Learning: Definition,Applications,Types—Supervised Learning, Unsupervised Learning, and Reinforcement learning

Machine Learning Pipeline: Data acquisition, Data preprocessing, Data cleaning,Label and one-hot encoding, Standardization and Normalization, Feature engineering, Training, and Testing dataset, Model evaluation metrics

Supervised Learning: Types**,** Simple Linear Regression, Multiple Linear Regression, Logistic Regression, k-Nearest Neighbour (kNN)

UNIT-III	**9 Hrs**

Supervised Learning: Decision Tree, Support Vector Machines, Naïve Bayes classifier

Unsupervised Learning: Concepts, Clustering techniques—K-Means Clustering, Hierarchical Clustering, DBSCAN clustering, K-medoids clustering

Ensemble Learning: Introduction, Types of ensembles, Voting and Averaging methods, Bagging, Random forests, Adaptive boosting (AdaBoost)

UNIT-IV	**9 Hrs**

Artificial Neural networks: History and evolution of neural networks, Applications of ANN, Artificial Neuron Model, Activation Functions, Neural Network Architecture

Introduction to Deep learning: Architecture, Historical Trends, Deep Feed-Forward Networks, Gradient-Based Learning, Hidden units, Back Propagation

Convolutional Neural Networks: Overview, Pooling layer, padding, types of padding

Recursive Neural networks: Overview of RNN Architecture and implementation of RNN

Textbook(s):

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 3rd Edition, Pearson, 2010 (*Chapters 1 to 8*)
2. Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das,*Machine Learning*, Pearson, 2nd edition, 2020, New Delhi *(Chapters 1 to 11)*

Reference Book(s):

1. Sudip Misra, Anandarup Mukherjee, Arijit Roy, *Introduction to IOT*, Cambridge University Press, 1st ed, ISBN: 1108959741
2. Jason Bell, *Machine Learning: Hands-On for Developers and Technical Professionals*, John Wiley & Sons, 1st ed, ISBN-13: 978-1118889060, 2014
3. Elaine Rich and Kevin Knight, *Artificial Intelligence*, 2nd ed, New Delhi: Tata McGraw-Hill, 2002
4. William W Hsieh, *Machine Learning Methods in the Environmental Sciences, Neural Networks*, Cambridge University Press, ISBN -13: 978-0805822410, 2009
5. Anil K Jain, *Fundamentals of Image Processing*, 1st ed, Chennai: Pearson, 2015

Web and Video link(s):

1. https://nptel.ac.in/courses/106106139, *NPTEL Video Lecture on Artificial Intelligence by Prof Deepak Khemani, Department of Computer Science and Engineering, IIT Madras*
2. *https://nptel.ac.in/courses/106105152 NPTEL Video Lecture on Introduction to Machine Learning by Prof Balaraman Ravindran, Department of Computer Science and Engineering, IIT Madras*

Course Articulation Matrix (CAM):		**U24IN502: ARTIFICIAL INTERNET OF THINGS**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24IN502.1**	1	2	2	1	-	-	1	-	1	-	2	2	2
CO2	**U24IN502.2**	2	2	2	2	-	-	1	-	1	-	2	2	2
CO3	**U24IN502.3**	2	2	2	2	-	-	1	-	1	-	2	2	2
CO4	**U24IN502.4**	2	2	3	3	-	-	1	-	1	-	2	2	2
U24IN502		1.75	2	2.25	1.75	-	-	1	-	1	-	2	2	2
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	**The student should be able to…**	**CO, Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	apply iot data processing, ai fundamentals, intelligent agents, search techniques, and game-playing algorithms to design intelligent iot systems for real-world applications	SDG 9	Industry, Innovation and Infrastructure	CO1 supports smart infrastructure, automation, and innovative IoT solutions that improve industrial efficiency and technological advancement
CO2	apply machine learning concepts, preprocessing methods, model development pipeline, and evaluation metrics to build and assess predictive models for real-world applications	SDG 4	Quality Education	CO2 develops analytical, technical, and problem-solving skills in students through practical machine learning model development
CO3	apply supervised and unsupervised machine learning techniques, including regression, classification, and clustering algorithms, to solve iot-based data analysis problems	SDG 11	Sustainable Cities and Communities	CO3 enables smart city applications such as traffic prediction, waste management, energy optimization, and public safety using IoT analytics
CO4	demonstrate understanding of deep learning and generative ai concepts, including neural networks, cnns, and lstm models for iot applications	SDG 9	Industry, Innovation and Infrastructure	CO4 promotes advanced AI-driven IoT innovations in automation, intelligent monitoring, and next-generation smart systems

AUTOMATA THEORY AND COMPILER DESIGN			
Class: B. Tech. V – Semester		**Branch:** CSE (IoT)	
Course Code:	**U24IN503**	**Credits:**	**3**
Hours/Week (L-T-P- E):	**2-1-0-3**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1 : apply finite automata to solve basic computational problems

CO2 : apply regular expressions and context-free grammars for generating languages

CO3 : apply pushdown automata and Turing machines for an efficient language processing system

CO4 : apply syntax, intermediate code, and code generation in the development of a compiler

UNIT-I	9 Hrs

Automata Theory: Introduction to finite automata, Structural representations and the central concepts of automata theory

Finite Automata: Deterministic finite automata (DFA), Non-deterministic finite automata (NFA), Finite automata with epsilon transitions, Conversion of NFA with €-transitions to NFA without €- transitions Conversion of NFA to DFA, Moore and Mealy machines, Minimisation of DFA

UNIT-II	9 Hrs

Regular Expressions: Introduction, Algebraic laws for regular expressions, From DFA to regular expressions, Conversion of regular expressions to automata, Pumping lemma for regular languages, Closure properties of regular languages

Context-Free Grammars (CFG): Definition, Derivations using grammar, Leftmost, and rightmost derivations, Parse trees, Ambiguity in grammars and languages, Removal of ambiguity in grammars, Pumping lemma of context-free languages, Chomsky normal form (CNF)

UNIT-III	9 Hrs

Push Down Automata (PDA): Definition, Acceptance by final state, Acceptance by empty store, Conversion of CFG to PDA

Turing Machines: Introduction, Formal description, Instantaneous description, The language of a Turing machine, problems on design of basic Turing machine, undecidability, Post correspondence problem

Compiler Design: Language processors, The structure of a compiler, interpreter, compiler

Lexical Analysis: The role of the lexical analyser, Input buffering, and recognition of tokens

UNIT-IV	9 Hrs

Syntax Analysis: Introduction, The role of parser, Top-down parsing, model of a non-recursive predictive parser, construction of a LL(1) parsing table, Bottom-up parsing, Model of an LR parser, construction of a simple LR parsing table, More powerful LR parsers

Intermediate-code Generation: Intermediate languages, Syntax trees, Three-address code

Code Generation: Basic blocks and flow graphs, Direct acyclic graphs for basic blocks, transformations on basic blocks

Textbook(s):

1. John E Hopcroft, Rajeev Motwani, Jeffrey D Ullman, Introduction to Automata Theory, Languages, and Computation, 3rd ed, USA: Pearson Education, 2007
2. Alfred V Aho, Monica S Lam, Ravi Sethi, Jeffry D Ullman, Compilers: Principles,

Techniques and Tools, 2nd ed, USA: Pearson Education, 2007

Reference Book(s):

1. Mishra, Chandrashekaran, Theory of Computer Science – Automata languages and computation, 2nd ed, India: Prentice Hall India Learning Private Limited, 2006
2. Michael Sipser, An Introduction to the Theory of Computation, 3rd ed, USA: Cengage Learning, 2013
3. Kamala Krithivsan, Rama R, Introduction to Formal Languages, Automata Theory and Computation,1st ed, India: Pearson Education, 2013
4. Peter Linz, Jones & Bartlett, An Introduction to Formal Languages and Automata, 6th ed, USA: Jones & Bartlett Learning, 2017

Web and Video link(s):

1. https://onlinecoursesnptel.ac.in/noc21_cs83/preview, NPTEL video lecture on theory of computation by Prof.Raghunath Tewari, IIT Kanpur
2. https://onlinecoursesnptel.ac.in/noc21_cs07/preview, NPTEL video lecture on compiler design by Prof.Santanu Chattopadhyay,IIT Kharagpur

Course Articulation Matrix (CAM):		U24IN503 : AUTOMATA THEROY AND COMPILER DESIGN												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24IN503.1	1	2	2	1	-	-	1	-	1	-	2	1	1
CO2	U24IN503.2	2	2	2	2	-	-	1	-	1	-	2	1	1
CO3	U24IN503.3	2	2	2	2	-	-	1	-	1	-	2	1	1
CO4	U24IN503.4	2	2	3	3	-	-	1	-	1	-	2	1	1
U24IN503		1.75	2	2.25	1.75	-	-	1	-	1	-	2	1	1
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	apply image pre-processing techniques	SDG3	Good Health and Well-being	Image pre-processing enhances medical images (MRI, CT, X-ray) by reducing noise and improving contrast, enabling accurate diagnosis and early disease detection
CO2	apply frequency domain filtering, restoration and reconstruction techniques	SDG9	Industry, Innovation and Infrastructure	Frequency domain filtering and restoration techniques improve image quality in industrial and satellite imaging systems, supporting reliable infrastructure monitoring and innovation
CO3	apply morphological processing and segmentation techniques	SDG11	Sustainable Cities and Communities	Image segmentation and morphological analysis enable applications like traffic analysis, surveillance, and urban monitoring, contributing to safer and smarter cities
CO4	apply feature extraction and classification techniques	SDG9	Industry, Innovation and Infrastructure	Feature extraction and classification form the backbone of AI-driven systems such as autonomous vehicles, industrial automation, and smart analytics, fostering technological innovation

DESIGN AND ANALYSIS OF ALGORITHMS			
Class: B. Tech. V – Semester		**Branch:** CSE (IoT)	
Course Code:	**U24IN504**	**Credits:**	**3**
Hours/Week (L-T-P- E):	**2-1-0-3**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1 : apply divide and conquer strategy for searching and sorting techniques with performance

CO2 : analyze 0/1 Knapsack problem, optimal merge pattern and single source shortest path algorithms using greedy method and N-Queen problem, graph colouring problem using backtracking method

CO3 : design of algorithms using dynamic programming approach to find the shortest path

CO4 : analyze and categorize NP-Hard and NP-Complete problems for the classes of P and NP

UNIT-I	**9 Hrs**

Introduction: Algorithm analysis, Performance analysis, Space complexity and time complexity, Big 'O' notation, Omega notation, Theta notation, Different mathematical approaches for solving time complexity of algorithms

Sets and Disjoint Set Union: Introduction, Union, Find operations

Divide and Conquer: General method, Binary search, Merge sort, Quick sort, Strassen's matrix multiplication

UNIT-II	**9 Hrs**

Greedy Method: General method, Knapsack problem, Job sequencing with deadlines, Optimal storage on tapes, Optimal merge patterns, Single source shortest paths

Backtracking: General method, N-Queens problem, Sum of subsets, Graph coloring problem

UNIT-III	**9 Hrs**

Dynamic Programming Concepts: General method, Multistage graphs, All pairs shortest paths, Single source shortest paths

Applications in Optimization Problems: Optimal binary search trees, String editing, 0/1 Knapsack problem, Reliability design problem, Travelling sales person problem

UNIT-IV	**9 Hrs**

Branch and Bound: General method, Least cost (LC) search, The 15-puzzle problem, Control abstractions for LC search, 0/1 Knapsack problem, Travelling salesperson problem

NP Hard and NP Complete Problems: Basic concepts, Nondeterministic algorithms, The classes NP-hard and NP-complete, COOK's theorem, NP-hard graph problems – Clique decision problem, Node cover decision problem, Traveling sales person decision problem

Textbook:

1. E Horowitz, S Sahni, S Rajasekaran, *Fundamentals of Computer Algorithms*, 2nd ed., Hyderabad, *(Chapters 1 to 12)*

Reference Book(s):

1. Thomas H. Cormen, Charles E Leiserson, Ronald L Rivest, Clifford Stein, *Introduction to Algorithms*, 3rd ed, Prentice-Hall of India, New Delhi, 2010
2. Gajendra Sharma, *Design and Analysis of Algorithms*, 4th ed, Rajput: Khanna Publishing, 2019
3. S Sridhar, *Design and Analysis of Algorithms*, 3rd ed, UK: Oxford University Press, India, 2015

Web and Video link(s):

1. https://onlinecoursesnptel.ac.in/noc19_cs47/preview, *NPTEL Video Lecture on Design and analysis of algorithms by Prof Madhavan Mukund Director Chennai Mathematical Institute H1, SIPCOT IT Park, Siruseri, Kelambakkam 603 103, INDIA*

Course Articulation Matrix (CAM):		**U24IN504: DESIGN AND ANALYSIS OF ALGORITHMS**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24IN504.1**	3	3	2	2	1	-	-	1	1	1	-	2	1
CO2	**U24IN504.2**	3	3	3	2	1	-	-	1	1	1	-	2	1
CO3	**U24IN504.3**	3	3	3	2	1	-	-	1	1	1	-	2	1
CO4	**U24IN504.4**	2	2	2	2	1	-	-	1	1	1	-	2	1
U24IN504		2.75	2.75	2.5	2	1	-	-	1	1	1	-	2	1
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	apply divide and conquer strategy for searching and sorting techniques with performance	SDG9	Industry, Innovation and Infrastructure	Efficient divide and conquer algorithms improve computational performance in large-scale systems such as databases, search engines, and network infrastructure, enabling scalable and innovative solutions
CO2	analyze 0/1 Knapsack problem, optimal merge pattern and single source shortest path algorithms using greedy method and N-Queen problem, graph colouring problem using backtracking method	SDG8	Decent Work and Economic Growth	Optimization and resource allocation problems help improve decision-making in logistics, scheduling, and business operations, supporting productivity and economic growth
CO3	design of algorithms using dynamic programming approach to find the shortest path	SDG11	Sustainable Cities and Communities	Dynamic programming techniques are used in route optimization, traffic management, and urban planning systems, contributing to efficient and sustainable city infrastructure
CO4	analyze and categorize NP-Hard and NP-Complete problems for the classes of P and NP	SDG4	Quality Education	Understanding computational complexity enhances problem-solving skills and theoretical knowledge, strengthening advanced education and research in computer science

SOFTWARE ENGINEERING			
Class: B Tech V–Semester		**Branch:**CSE(IoT)	
Course Code:	**U24IN505**	**Credits:**	**3**
Hours/Week (L-T-P-E):	**2-1-0-3**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1: apply the appropriate software model for implement the given real time application

CO2 : develop different types of software designs and patterns

CO3: apply an appropriate testing method for a given software

CO4: apply metrics to assess the quality of software and analyse the risk management in project scheduling

UNIT-I	**9 Hrs**

Software Engineering Concepts: The changing nature of software, Software application domains, Legacy software, Software myths, Software engineering layered technology, A process framework, The capability maturity model integration (CMMI), Agile software

Process Models: Prescriptive process models, RAD model, Specialized process models, Unified process model, Personal and team process models

Agile Development: Agility and the cost of change, Agile process, Extreme programming, Other agile process models

Software Engineering Practices:(Principles that Guide the Practice) Communication principles, Planning principles, Modeling principles, Construction principles, Deployment principles

UNIT-II	**9 Hrs**

Requirements Engineering Tasks: Requirements analysis and modeling strategies, User requirement, System requirement, Software requirements document

Design Engineering: Design within the context of software engineering, Design process, Design concepts, The design model

Architectural Design: Software architecture, Architectural genres, Architectural styles, Architectural design, Assessing alternative architectures, Designing class based components, Conducting component level design, Design for WebApps, Designing traditional components

UNIT-III	**9 Hrs**

User Interface Design: The golden rules, User interface analysis and design, Interface analysis, Interface design steps, WebApp and mobile interface design

Testing Strategies: Software testing fundamentals, Test strategies for conventional software, Test strategies for object-oriented software, Validation testing, System testing, The art of Debugging, White box testing, Basis path testing, Control structure testing, Black box testing

Testing Web Applications: Testing concepts for webapps, The testing process, Content testing, User interface testing, Component-level testing, Navigation testing, Configuration testing, Security testing, Performance testing

UNIT-IV	**9 Hrs**

Product Metrics: Measures, Metrics and indicators, Metrics for the requirements model, Metrics for the design model, Metrics for source code, Metrics for testing, Metrics for maintenance

Process and Project Metrics: Metrics in the process and project domains, Software measurement, Metrics for software quality, Integrating metrics within the software process,

The W5HH principle

Project Scheduling: Project scheduling, Scheduling for WebApps projects, Earned value analysis

Risk Management: Reactive versus Proactive risk strategies, Software risks, Risk identification, Risk projection, Risk refinement, RMMM plan

Textbook(s):

1. Roger S Pressman and Bruce R Maxim, *Software Engineering: A Practitioner's Approach*, 8th ed, New Delhi: McGraw Hill, 2019

Reference BooksS):

1. Ian Sommerville, *Software Engineering*, 10th ed., Delhi: Pearson Education, 2016
2. Deepak Jain, *Software Engineering: Principles and Practices*, 3rd ed, Delhi: Oxford University Press, 2008
3. Pankaj Jalote, *Software Engineering: A Precise Approach*, New Delhi: Wiley India, 2010
4. Waman S Jawadekar, *Software Engineering: A Primer*, New Delhi: Tata McGraw Hill, 2008

Web and Video link(s):

https://onlinecourses.nptel.ac.in/noc19_cs47/preview,

Course Articulation Matrix (CAM):		**U24IN505: SOFTWARE ENGINEERING**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24IN505.1**	1	2	2	1	-	-	1	-	1	-	2	2	2
CO2	**U24IN505.2**	2	2	2	2	-	-	1	-	1	-	2	2	2
CO3	**U24IN505.3**	2	2	2	2	-	-	1	-	1	-	2	2	2
CO4	**U24IN505.4**	2	2	3	3	-	-	1	-	1	-	2	2	2
U24IN505		1.75	2	2.25	1.75	-	-	1	-	1	-	2	2	2
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	apply the appropriate software model for implementing a given real-time application	SDG9	Industry, Innovation and Infrastructure	Selecting suitable software development models (eg, Agile, Waterfall) supports the development of innovative and reliable software systems, contributing to technological advancement and industrial growth
CO2	develop different types of software designs and patterns	SDG4	Quality Education	Designing software systems using patterns enhances problem-solving and learning skills, enabling students to develop structured, maintainable solutions aligned with modern educational practices
		SDG9	Industry, Innovation and Infrastructure	Software design and architectural patterns contribute to building scalable and efficient digital infrastructure, supporting innovation in software industries
CO3	apply an appropriate testing method for a given software	SDG3	Good Health and Well-being)	Software testing ensures reliability and safety of applications, especially in healthcare and critical systems, thereby supporting well-being and reducing risks caused by software failures
		SDG9	Industry, Innovation and Infrastructure	Effective testing improves software quality and system robustness, contributing to dependable digital infrastructure and innovation
CO4	apply metrics to assess the quality of software and analyze risk management in project scheduling	SDG8	Decent Work and Economic Growth)	Software quality metrics and risk management improve project efficiency, reduce failures, and enhance productivity in software industries, supporting economic growth
		SDG9	Industry, Innovation and Infrastructure	Applying metrics and risk analysis ensures development of reliable, scalable systems and effective project execution, strengthening technological infrastructure

ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

Class: B.Tech. V- Semester		**Branch:** (CE, ME, IT, CSN, CSM, CSO, CSD)	
Course Code:	**U24IK506B**	**Credits:**	**2**
Hours/Week (L-T-P-E):	**2-0-0-2**	**CIE:**	**60%**
Total Number of Teaching Hours:	**24 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1 : summarize the basic structure of Vedas, Upavedas, Vedanga, Upanga

CO2 : explain Vedas as principal source of knowledge for scientific inventions

CO3 : describe different yogasanas, breathing techniques, chakras, meditation and their benefits

CO4 : discuss the benefits of yoga as an effective tool for management of human crisis

UNIT-I	**6 Hrs**

Basic Structure of Indian Knowledge System: Introduction, Vedas – origin, classification, structure, Rig veda, Sama veda, Yajur veda, Atharva veda, Upa vedas – Dhanur veda, Sthapat veda, Gandharva veda, Ayur veda, Vedanga – Shiksha, Chanda, Vyakarna, Nirukta, Kalpa, Jyothisha, Upanga – Dharmashastra, Mimamsa, Tarkashastra, Purana

UNIT-II	**6 Hrs**

Modern Science and Indian Knowledge System: Introduction, Vedas as basis for modern science, Architectural developments, Medicine and its relevance, Mathematical sciences in vedas, Space and military related developments, Chemical sciences

UNIT-III	**6 Hrs**

Yoga and Holistic Health Care: Healthy mind in healthy body, yoga: Definition, Types, Yoga to keep fit: diet, Yoga asanas, Fundamentals, Breathing techniques in patanjali yoga tradition, pranayama, Chakras, Meditation, Benefits of yoga – Physical health, Emotional health, Prevention of disease, Reducing or alleviating symptoms of problems

UNIT-IV	**6 Hrs**

Case Studies – Yoga Practice: Yoga as an effective tool for management of human crisis – Depression, Self-concept & mental health, Yoga for stress management, Yoga: a way to cure for insomnia

Requisite: Yoga practice sessions are to be conducted for all students taking this course by the time they complete Unit 1 and Unit 2

Textbook(s):

1. Sathish Chandra Chaterjee, Dhirendramohan Datta, *An Introduction to Indian Philosophy*, New Delhi: Rupa Publications Pvt Ltd (Chapter 2, 3)
2. Priyadaranjan Ray, SN Sen, *The Cultural Heritage of India*, Vol 6, Science and Technology, Kolkata: The Ramakrishna Mission Institute of Culture
3. *Yoga Sutra of Patanjali*, Kolkata: Ramakrishna Mission
4. RN Jha, *Science of Consciousness Psychotherapy and Yoga Practices*, New Delhi: VidyanidhiPrakasham, 2016 (Chapter 4, 5, 6, 7, 8)

Reference Book(s):

1. Swami Jitatmananda, *Holistic Science and Vedanta,* Mumbai: Bharatiya Vidya Bhavan (Chapter 2, 3)

Web and Video link(s):

1. NPTEL courses on Indian Philosophy, Yoga and Vedic Sciences available at https://onlinecourses.nptel.ac.in.

Course Articulation Matrix (CAM):		U24IK506B: ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE													
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	U24IK506B.1	-	-	-	-	-	1	-	2	1	1	-	-	-	-
CO2	U24IK506B.2	-	-	-	-	-	1	1	2	1	1	-	-	-	-
CO3	U24IK506B.3	-	-	-	-	-	1	-	2	2	1	-	2	-	-
CO4	U24IK506B.4	-	-	-	-	-	1	1	2	2	1	-	2	-	-
U24IK506B		-	-	-	-	-	1	1	2	1.5	1	-	2	-	-
		3 – HIGH, 2 – MEDIUM, 1 - LOW													

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	summarize the basic structure of Vedas, Upavedas, Vedanga, Upanga	SDG4	Quality Education	Understanding the foundational structure of Indian knowledge systems supports holistic education, critical thinking, and cultural literacy, contributing to quality and inclusive education
CO2	explain Vedas as principal source of knowledge for scientific inventions	SDG9	Industry, Innovation and Infrastructure	Recognizing Vedic contributions to science and technology highlights indigenous innovation in areas such as mathematics, architecture and medicine, inspiring modern sustainable technological development
CO3	describe different yogasanas, breathing techniques, chakras, meditation and their benefits	SDG3	Good Health and Well-being	Knowledge of yoga, pranayama, and meditation directly promotes physical health, mental well-being, and disease prevention, supporting the SDG goal of ensuring healthy lives for all
CO4	discuss the benefits of yoga as an effective tool for management of human crisis	SDG3	Good Health and Well-being	Understanding yoga as a therapeutic tool for depression, stress, and insomnia contributes to mental health management and holistic wellness, aligning with SDG3 targets on mental health

FULL STACK DEVELOPMENT LABORATORY			
Class: B Tech V – Semester		**Branch:** CSE (IoT)	
Course Code:	**U24IN507**	**Credits:**	**1**
Hours/Week (L-T-P- E):	**0-0-2-2**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1 : design and implement server-side applications using Nodejs and Express, and perform database operations using MongoDB along with basic React UI development

CO2 : develop and integrate full-stack applications using React and REST APIs, implementing authentication and deploying MERN applications

CO3 : build web applications using Django framework, including models, ORM-based database operations, templates, and form handling

CO4 : develop and deploy full-stack Django applications using Django REST Framework, implementing authentication and complete application workflows

Experiment-1 : Nodejs & Express Basics

1. Setup Nodejs project using npm and create a simple HTTP server
2. Create REST APIs using Express (GET, POST)
3. Test APIs using Postman / Thunder Client

Experiment-2 : MongoDB Integration

1. Connect Nodejs app with MongoDB using Mongoose
2. Implement CRUD operations (Create, Read, Update, Delete)
3. Design a schema for a sample entity (User/Product)

Experiment-3: React Basics

1. Setup React app using Vite / Create React App
2. Create functional components and use props & state
3. Implement form handling and validation

Experiment-4: Frontend–Backend Integration

1. Fetch API data from Express backend using Axios
2. Display dynamic data in React components
3. Implement CRUD UI (Add/Delete/Update items)

Experiment-5 : Authentication & Routing

1. Implement JWT-based authentication
2. Create login & registration APIs
3. Protect routes in React (Private Routes)

Experiment-6 : MERN

1. Develop a Full Stack App (Student Manager)
2. Implement authentication + CRUD
3. Deploy app (Render / Netlify / Vercel)

Experiment-7: Django Basics

1. Install Django and create project + app
2. Explore MVT architecture (Models, Views, Templates)
3. Create basic URL routing and views

Experiment-8: Models & Database

1. Define models and run migrations
2. Perform CRUD operations via Django ORM

3. Register models in Django Admin

Experiment-9: Templates & Forms

1. Create HTML templates using Django Template Engine
2. Handle forms using Django Forms
3. Implement validation and error handling

Experiment-10: Django REST Framework

1. Setup Django REST Framework
2. Create serializers and API views
3. Implement CRUD APIs

Experiment-11: Authentication & Integration

1. Implement token-based authentication
2. Connect Django APIs with frontend (React/Postman)
3. Role-based access control (optional advanced)

Experiment-12: Build production-ready app using

1. Develop Full Stack Django App (Blog / Inventory / LMS)
2. Integrate frontend + backend
3. Deploy using PythonAnywhere / Render

Textbook(s):

1. Subramanian V *Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node* 2nd ed Apress, 2019 ISBN: 978-1484255513
2. Mele A *Django 5 By Example: Build Powerful and Reliable Python Web Applications from Scratch* Packt Publishing, 2024 ISBN: 978-1837633876

Reference Book(s):

1. Iriarte Koroliova EW *MERN Quick Start Guide: Build Web Applications with MongoDB, Expressjs, React, and Node* Packt Publishing, 2018 ISBN: 978-1787281080
2. Ravindran A *Django Design Patterns and Best Practices* 2nd ed Packt Publishing, 2018 ISBN: 978-1788831345

Web and Video link(s):

https://youtube/bWACo_pvKxg?si=HqvJFieulNxNaii3

Laboratory Manual (for laboratory component):

1. *Full Stack Development Laboratory Manual,* Department of CSE (Networks), KITSW

Course Articulation Matrix (CAM):		U24IN507 : FULL STACK DEVELOPMENT LABORATORY												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24IN507.1	2	2	2	1	2	1	1	1	1	-	2	2	2
CO2	U24IN507.2	2	2	2	2	2	1	1	1	1	-	2	2	2
CO3	U24IN507.3	2	2	2	2	2	1	1	1	1	-	2	2	2
CO4	U24IN507.4	2	2	3	3	3	1	1	1	1	-	2	2	2
U24IN507		2	2	2.25	2	2.25	1	1	1	1	-	2	2	2
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	implement basic devops operations using git, linux commands, and shell scripting	SDG4	Quality Education	Practical exposure to version control, Linux, and scripting enhances technical competency and promotes hands-on learning aligned with modern industry practices
CO2	develop nodejs-based automation scripts and manage dependencies using npm and build tools	SDG9	Industry, Innovation and Infrastructure	Nodejs automation and dependency management enable efficient software development workflows, supporting scalable and innovative digital infrastructure
CO3	implement containerization and deployment using docker and kubernetes	SDG9	Industry, Innovation and Infrastructure	Containerization and orchestration technologies support scalable, reliable, and efficient deployment of applications in modern cloud infrastructure
CO4	design and implement ci/cd pipelines integrating nodejs applications using jenkins	SDG8	Decent Work and Economic Growth	CI/CD automation improves productivity, reduces manual effort, and enhances software delivery efficiency, contributing to modern digital workforce practices

ARTIFICIAL INTELLIGENCE FOR IOT LABORATORY			
Class: B. Tech. V – Semester		**Branch:** CSE (IoT)	
Course Code:	**U24IN508**	**Credits:**	**1**
Hours/Week (L-T-P- E):	**0-0-2-2**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1 : develop Python programs using scientific computing and data analysis libraries for analytical applications

CO2 : develop Python programs for implementing data preprocessing and machine learning techniques using scikit-learn and Linear Regression analysis on real-world datasets

CO3 : develop Python programs using scikit-learn to implement supervised machine learning algorithms

CO4 : develop Python programs to implement advanced machine learning and deep learning techniques

Experiment-1 (UNIT-I)

1. Install and configure Python IDE software such as Anaconda and Jupyter Notebook, set up the NumPy environment and develop programs using NumPy

Experiment-2 (UNIT-I)

1. Install and setup *pandas* environment and develop Programs on Pandas

Experiment-3 (UNIT-I)

1. Use a suitable machine learning dataset to develop Python programs using the matplotlib library for visualizing data

Experiment-4 (UNIT-II)

1. Develop a Python program demonstrating data cleaning and transformation preprocessing techniques such as handling missing values, removing duplicate records, detecting outliers, label encoding, one-hot encoding, and data transformation using a suitable dataset

Experiment-5 (UNIT-II)

1. Develop a Python program to demonstrate preprocessing techniques such as feature scaling, normalization, standardization, and numerical data transformation using a suitable dataset

Experiment-6 (UNIT-II)

1. Install the scikit-learn Python library and develop a Python program to implement the Linear Regression machine learning algorithm to analyze relationships between different real-world datasets, such as unemployment rates and stock market gains, etc.,

Experiment-7 (UNIT-III)

1. Install the scikit-learn Python library and develop a Python program to implement the multi-linear regression machine learning algorithm to analyze relationships between real-world datasets, such as unemployment rates and stock market gains

Experiment-8 (UNIT-III)

1. Develop a Python program for Email Spam Detection using the logistic regression Classification algorithm with a self-created or publicly available machine learning dataset

Experiment-9 (UNIT-III)

1. Develop a Python program to implement the Machine Learning Decision Tree / Naïve Bayes Algorithm for classification or prediction using a self-created or publicly available dataset

Experiment-10 (UNIT-IV)

1. Develop a Python program implementing a Machine Learning any Clustering algorithm using a self-created or publicly available dataset

Experiment-11 (UNIT-IV)

1. Design and implement a Feedforward Artificial Neural Network (ANN) using TensorFlow and Keras to classify handwritten digits from the MNIST dataset Train the model, evaluate its accuracy, and analyze its performance

Experiment-12 (UNIT-IV)

1. Develop and implement a Convolutional Neural Network (CNN) using TensorFlow and Keras to perform image classification on a suitable benchmark dataset Train, validate, and evaluate the model's performance using appropriate metrics, and analyze the effectiveness of CNN architectures in extracting and classifying image features

Textbook(s):

1. Peter Flach, Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press, 1st ed, ISBN: 978-1 -107-09639-4, 2012
2. Stephen Marsland, Taylor & Francis, Machine Learning: An Algorithmic Perspective, CRC, ISBN -13: 978-1420067187, 2009

Reference Book(s):

1. Tom M Mitchell, Machine Learning, MGH, Indian Edition, ISBN 1259096955, 2013
2. S Russell and P Norvig, Artificial Intelligence – A Modern Approach, 2nd ed, Pearson Education, 2003, ISBN: 978-0137903955
3. Jason Bell, Machine Learning: Hands-On for Developers and Technical Professionals, John Wiley & Sons, 1st ed, ISBN-13: 978-1118889060, 2014
4. William W Hsieh, Machine Learning Methods in the Environmental Sciences, Neural Networks, Cambridge University Press, ISBN -13: 978-0805822410, 2009

Laboratory Manual (for laboratory component):

Artificial Intelligence for IoT Laboratory Manual, Department of CSE (IoT), KITSW

Course Articulation Matrix (CAM):		**U24IN508: ARTIFICIAL INTELLIGENCE FOR IOT LABORATORY**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24IN508.1**	2	2	2	1	2	1	1	1	1	-	-	2	2
CO2	**U24IN508.2**	2	2	2	2	2	1	1	1	1	-	2	2	2
CO3	**U24IN508.3**	2	2	2	2	2	1	1	1	1	-	2	2	2
CO4	**U24IN508.4**	2	2	3	3	3	1	1	1	1	-	2	2	2
U24IN508		2	2	2.25	2	2.25	1	1	1	1	-	2	2	2
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO – SDG Alignment Matrix				
CO	**CO Statement** ***The student should be able to***	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	develop python code for implementing numpy, pandas, and matplotlib libraries	SDG4	Quality Education	Use of NumPy, Pandas, and Matplotlib enhances data analysis and visualization skills, promoting quality education and data literacy for solving real-world IoT problems
CO2	develop python code for implementing regression and cluster analysis algorithms used in iot applications	SDG9	Industry, Innovation and Infrastructure	Regression and clustering techniques enable predictive analytics and pattern discovery in IoT data, supporting smart systems, innovation, and resilient infrastructure development
CO3	develop python code for implementing bayesian and deep learning algorithms used in iot applications	SDG9	Industry, Innovation and Infrastructure	Bayesian methods and deep learning models improve intelligent decision-making and automation in IoT, driving technological innovation and sustainable industrial solutions
CO4	develop python code for implementing cnn, rnn, and image processing applications used in iot applications	SDG11	Sustainable Cities and Communities	CNN, RNN, and image processing techniques enable smart city applications such as traffic monitoring, surveillance, and environmental sensing, contributing to sustainable and livable communities

DESIGN AND ANALYSIS OF ALGORITHMS LABORATORY

Class: B. Tech. V – Semester		**Branch:** CSE (IoT)	
Course Code:	**U24IN509**	**Credits:**	**1**
Hours/Week (L-T-P- E):	**0-0-2-2**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1 : demonstrate programs on binary search, min-max, merge sort, quicksort and strassen's matrix multiplication problems

CO2 : develop knapsack, job sequencing with deadline, shortest path using greedy method, N-Queens and sum of subsets using backtracking method

CO3 : construct programs on single source shortest path, multistage graph and all pairs shortest path using dynamic programming technique

CO4 : develop programme for travelling sales person problem using branch and bound method

Experiment-1 (UNIT-I)

1. Develop a program to implement binary search algorithm
2. Develop a program to implement min-max algorithm

Experiment-2 (UNIT-I)

1. Develop a program to implement merge sort algorithm
2. Develop a program to implement quick sort algorithm

Experiment-3 (UNIT-I)

1. Apply Strassen's matrix multiplication to multiply following matrix

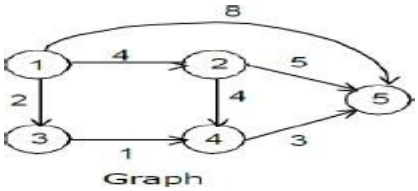
$$A=\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix} \qquad B=\begin{pmatrix} 2 & 1 \\ 4 & 3 \end{pmatrix}$$

Experiment-4 (UNIT-II)

1. Develop a program to implement 0/1 knapsack problem
2. Develop a program to implement Job sequencing with deadlines

Experiment-5 (UNIT-II)

1. Apply Dijkstras algorithm find the shortest path from 1 to each of the other five vertices in the graph



Graph

2. Develop a program to implement N-Queens problem

Experiment-6 (UNIT-II)

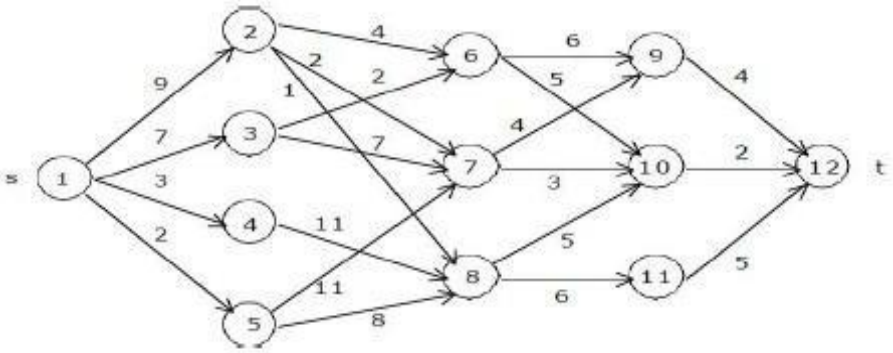
1. Develop a program to implement sum of subsets

Experiment-7 (UNIT-II)

1. Implement Single source shortest paths using bellman ford algorithm

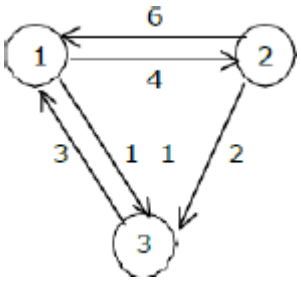
Experiment-8 (UNIT-III)

1. Apply Multistage graph algorithm and find shortest path



Experiment-9 (UNIT-III)

1. Apply All pairs shortest paths algorithm and find shortest path



Experiment-10 (UNIT-III)

1. Develop a program to implement Optimal binary search trees

Experiment-11 (UNIT-IV)

1. Apply travelling sales person algorithm using dynamic programming and find shortest path

$$\begin{pmatrix} 0 & 10 & 15 & 20 \\ 5 & 0 & 9 & 10 \\ 6 & 13 & 0 & 12 \\ 8 & 8 & 9 & 0 \end{pmatrix}$$

Experiment-12 (UNIT-IV)

1. Apply travelling salesperson algorithm using branch and bound and find shortest path

$$\begin{pmatrix} \infty & 20 & 30 & 10 & 11 \\ 15 & \infty & 16 & 4 & 2 \\ 3 & 5 & \infty & 2 & 4 \\ 19 & 6 & 18 & \infty & 3 \\ 16 & 4 & 7 & 16 & \infty \end{pmatrix}$$

Textbook:

1. E Horowitz, S Sahni, S Rajasekaran, *Fundamentals of Computer Algorithms*, 2nd ed, Hyderabad: Universities Press, 2018 *(Chapters 1 to 12)*

Reference Book(S):

1. EHorowitz, S.Sahni, S.Rajasekaran, Fundamentals of Computer Algorithms, 2nd ed., Universities Press, 2018
2. Mark Allen Weiss, Data Structures and Algorithm Analysis in Java, 3rd ed., Pearson, 2012
3. Kathy Sierra, Bert Bates, Head First Java 8, 2nd ed., O"Reilly Publications, 2020
4. Narasimha Karumanchi, Data Structures and Algorithms Made Easy in Java, careermonk, 2011
5. Uttam K Roy, Advanced JAVA Programming, Oxford Publications, 2015

Web and Video link(s):

1. https://onlinecoursesnptel.ac.in/noc19_cs47/preview, *NPTEL Video Lecture on Design and analysis of algorithmsby Prof Madhavan Mukund Director Chennai Mathematical InstituteH1, SIPCOT IT Park, Siruseri, Kelambakkam 603 103, INDIA*

Laboratory Manual (for laboratory component):

1. *Design And Analysis Of Algorithms Laboratory Manual,* Department of CSE (Networks), KITSW

Course Articulation Matrix (CAM):		**U24IN509 : DESIGN AND ANALYSIS OF ALGORITHMS LABORATORY**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24IN509.1**	3	3	2	2	1	-	1	1	1	-	1	2	1
CO2	**U24IN509.2**	3	3	3	2	1	-	1	1	1	-	1	2	1
CO3	**U24IN509.3**	3	3	3	2	1	-	1	1	1	-	1	2	1
CO4	**U24IN509.4**	2	2	2	2	1	-	1	1	1	-	1	2	1
U24IN509		**2.75**	**2.75**	**2.75**	**2**	**1**	**-**	**1**	**1**	**1**	**-**	**1**	**2**	**1**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	demonstrate programs on binary search, min-max, merge sort, quick sort and Strassen's matrix multiplication problems	SDG9	Industry, Innovation and Infrastructure	Efficient algorithms improve computational speed and performance in software systems, enabling scalable solutions in industries such as data processing and scientific computing
CO2	develop knapsack, job sequencing with deadline, shortest path using greedy method, N-Queens and sum of subsets using backtracking method	SDG8	Decent Work and Economic Growth	Optimization and scheduling algorithms support efficient resource allocation, workforce planning, and operational productivity in industries
CO3	construct programs on single source shortest path, multistage graph and all pairs shortest path using dynamic programming technique	SDG11	Sustainable Cities and Communities	Pathfinding and optimization algorithms are applied in transportation systems, traffic management, and urban planning for smarter cities
CO4	develop programme for travelling salesperson problem using branch and bound method	SDG9	Industry, Innovation and Infrastructure	Advanced optimization techniques like branch and bound are used in logistics, supply chain management, and route optimization, improving industrial efficiency and infrastructure

SEMINAR			
Class: B. Tech. V – Semester		**Branch:** CSE (IoT)	
Course Code:	U24IN510	**Credits:**	**1**
Hours/Week (L-T-P- E):	**0-0-2-2**	**CIE:**	**60%**
Total Number of Teaching Hours:	**-**	**ESE:**	**40%**

Course Learning Outcomes (COs):

After completion of this course, the students should be able to,

CO1 select current topics in their engineering discipline & allied areas from peer reviewed journals/ technical magazines/ conference proceedings

CO2 demonstrate the skills for performing literature survey, identify gaps, analyze the technical content and prepare a well-documented seminar report

CO3 create informative PPT and demonstrate communication skills through effective oral presentation showing knowledge on the subject & sensitivity towards social impact of the seminar topic

CO4 write a "seminar paper" in scientific journal style & format from the prepared seminar report

Student has to take up independent topic on innovative ideas, to solve common problems using their knowledge relevant to courses offered in their program of study, which would supplement and complement the program assigned to each student

Seminar Guidelines:

1. The HoD shall constitute a Department Seminar Evaluation Committee (DSEC)
2. DSEC shall allot a faculty supervisor to each student for guiding on (i) selection of topic (ii) literature survey and work to be carried out (iii) preparing a report in proper format and (iv) effective seminar presentation
3. There shall be only Continuous Internal Evaluation (CIE) for seminar
4. The CIE for seminar is as follows:

Assessment	Weightage
Seminar Supervisor Assessment	20%
Seminar Report	30%
Seminar Paper	20%
DSEC Assessment:*Oral presentation with PPT andviva-voce*	30%
Total Weightage:	**100%**

Note: It is mandatory for the student to appear for oral presentation and viva-voce to qualify for course evaluation

(a) **Seminar Topic**: The topic should be interesting and conducive to discussion Topics may be found by looking through recent issues of peer reviewed Journals / Technical Magazines on the topics of potential interest

(b) **Report:** Each student is required to submit a well-documented report on the chosen seminar topic as per the format specified by*DSEC*

(c) **Anti-Plagiarism Check:** The seminar report should clear plagiarism check as per the Anti-Plagiarism policy of the institute

(d) **Presentation:** Each student should prepare PPT with informative slides and make an effective oral presentation before the *DSEC* as per the schedule notified by the department

(e) The student has to register for the Seminar as supplementary examination in the following cases:

i) he/she is absent for oral presentation and viva-voce

ii) he/she fails to submit the report in prescribed format

iii) he/she fails to fulfill the requirements of seminar evaluation as per specified guidelines

(f) (i) The CoE shall send a list of students registered for supplementary to the HoD concerned

ii) The DSEC, duly constituted by the HoD, shall conduct seminar evaluation and send the award list to the CoE within the stipulated time

Course Articulation Matrix (CAM):														**U24IN510: SEMINAR**		
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PSO 2**	**PSO 3**
CO1	U18IN510.1	1	1	-	1	1	-	1	2	2	2	1	2	1	1	1
CO2	U18IN510.2	1	1	-	1	1	-	1	2	2	2	1	2	1	1	1
CO3	U18IN510.3	1	1	-	1	1	-	1	2	2	2	1	2	1	1	1
CO4	U18IN510.4	1	1	-	1	1	-	1	2	2	2	1	2	1	1	1
U18IN510		1	1	-	1	1	-	1	2	2	2	1	2	1	1	1

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	select current topics in their engineering discipline and allied areas from peer-reviewed journals, technical magazines, and conference proceedings	SDG 4	Quality Education	Promotes lifelong learning, awareness of emerging technologies, and acquisition of current knowledge through scholarly resources
CO2	demonstrate the skills for performing literature survey, identifying gaps, analyzing technical content, and preparing a well-documented seminar report	**SDG 9**	**Industry, Innovation and Infrastructure**	Encourages research aptitude, critical thinking, innovation, and technical documentation skills essential for technological advancement
CO3	construct programs on single source shortest path, multistage graph and all pairs shortest path using dynamic programming technique	SDG11	Sustainable Cities and Communities	Enhances communication and knowledge-sharing skills while fostering awareness of the societal impact of engineering solutions
CO4	write a seminar paper in scientific journal style and format from the prepared seminar report	SDG 4 –SDG 9 – Industry, Innovation and Infrastructure	Quality Education, Industry, Innovation and Infrastructure	Develops scientific writing, research dissemination, and professional documentation skills that support innovation and knowledge transfer

VI SEMESTER (STREAM-II)

S No	Category	Course Code	Course Title	Lectures / week				Credits
				L	T	P	E	C
1	OE	U24OE601X -SE&B	Open Elective – S&EB(from Pool -XVIII)	2	1	-	3	3
2	PEC	U24IN602X	Program Elective –I / MOOCs-I	2	1	-	3	3
3	PCC	U24IN603	IoT Frameworks	2	1	-	3	3
4	PCC	U24IN604	Industrial IoT	2	1	-	3	3
5	PCC	U24IN605	DevOps	2	1	-	3	3
6	IKSC	U24IK606A	Universal Human Values - II	2	-	-	2	2
7	HSMC	U24MH607	Technical English	-	-	2	2	1
8	PCC	U24IN608	IoT Frameworks Laboratory	-	-	2	2	1
9	PCC	U24IN609	Industrial IoT Laboratory	-	-	2	2	1
10	PCC	U24IN610	DevOps Laboratory	-	-	2	2	1
11	ELC	U24IN611	Mini Project	-	-	2	2	1
			Total:	12	5	10	27	22
Additional Learning@:Maximum credits allowed for Honours/Minor				-	-	-	-	5
Total credits for Honours/Minor students:				**-**	**-**	**-**	**-**	**27**
Summer/ Inter-semBridge Courses (Approved by BoS and Dean,AA): 1 week to 10 days: 1 credit to each Bridge course under additional learning (will be printed on grade sheet)				**NIL**				

Pool -XVIII Startups & Entrepreneurship Basket (OE - S&EB)		
S No	**Course Code**	**Course Title**
	U24OE601A-SEB	Design Thinking
	U24OE601B-SEB	Innovative Product Design and Development
	U24OE601C-SEB	Entrepreneurship
	U24OE601D-SEB	Design Studio
	U24OE601Z-SEB	Any other course approved by BoS Chair and Dean AA

Program Elective –I / MOOCs-I		
S No	**Course Code**	**Course Title**
1	U24IN602A	Deep Learning
2	U24IN602B	Fundamentals of Cyber Security and Tools
3	U24IN602C	Statistical Fundamentals

DESIGN THINKING			
Class: B Tech – VI -Semester		**Branch:** Common to All	
Course Code:	**U24OE601A- SE&B**	**Credits:**	**3**
Hours/Week (L-T-P- E):	**2-1-0-3**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to…

CO1 : identify customer segments and needs, assess customer-problem fit using Jobs-to-be-Done (JTBD) and customer persona frameworks

CO2 : analyze market opportunities and competitive dynamics, estimate business feasibility and build prototypes/MVPs for validating innovative solutions

CO3 : develop a Lean Canvas for a start-up venture by integrating value proposition, customer segments, revenue streams, key metrics and growth strategies

CO4 : evaluate funding and team-building strategies and develop a scalable, investment-ready venture proposal through financial planning, validation and professional pitching

UNIT-I	**9 Hrs**

Identify and Analyze Real-world Problems: The macro industry view, Problem identification & segment assembly, Customer identification & needs validation, Assess 'jobs-to-be-done' (JTBD) for a customer segment, Develop customer persona, Validate customer-problem fit, pivot/refine customer-problem fit for feasibility, Examine ideation techniques

UNIT-II	**9 Hrs**

Solution Idea Generation & MVP: Opportunity & Competition Mapping, Prototype Development & Minimum Viable Product (MVP), Identify Global Competitors, Review Industry Trends and Estimate Market Size (TAM), Introduction to Financial Planning, Overview of Prototypes & MVP, Build an initial Prototype, Prototypes for Early Validation, Map your Relative Position in the Market, Estimate Opportunity Size

UNIT-III	**9 Hrs**

Market Feasibility & Business Modeling: Lean canvas assembly, Marketing & go-to-market (GTM) strategy, Examine revenue models, Review and organize lean canvas, Build LC for your start-up, Build LC for your start-up, Understand marketing and sales, Recommend a GTM approach, Map a sales process, Building an initial team

UNIT-IV	**9 Hrs**

Financial Management, Team Scale & Final Pitch: Funding pathways & scaling orientation, Validation & venture presentation/collaboration, Deep dive into financial planning, Analyse the path to profitability, Understand bootstrapping & funding options, Finding co-founders and mentors, Thinking beyond the prototype - Scale opportunity & orientation, Final milestone - Venture idea feasibility presentation

Textbook:

1. Chandramouli Subramanian & Thiyagarajan p, Sankaran V, Design Thinking: A Hands-on Approach, University Press (India) Pvt. Ltd., 1st Edn, 2025, Hyderabad

Reference Book(s):

1. Andrew Pressman, Design Thinking: A Guide to Creative Problem Solving for Everyone, Routledge, Taylor & Francis Group, 7th Edn, 2019, New York
2. George E Dieter and Linda C Schmidt, Engineering Design, McGraw-Hill Education, 13th Edn, 2020, New Delhi
3. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, HarperBusiness, 7th Edn, 2009, New York
4. Karl T Ulrich, Steven D Eppinger, and Maria C Yang, Product Design and Development, McGraw-Hill Education, 2020, New Delhi
5. Tom Kelley and David Kelley, Creative Confidence: Unleashing the Creative Potential Within Us All, Crown Business, 2013, New York
6. Idris Mootee, Design Thinking for Strategic Innovation, John Wiley & Sons, 1st Edn, 2013, New Jersey

Web and Video link(s):

https://nptel.ac.in/courses/110106124, *NPTEL Video Lecture on Design Thinking - A Primer by Prof Ashwin Mahalingam & Prof Bala Ramadurai, IIT Madras*

Course Articulation Matrix (CAM):		U24OE601A: SE&B - DESIGN THINKING												
CO		PO 1	PO2	PO 3	PO 4	PO5	PO6	PO 7	PO 8	PO 9	PO10	PO11	PSO1	PS O2
CO1	U24OE601A.1	2	2	1	1	1	1	1	1	1	1	1	1	1
CO2	.U24OE601A2	1	2	2	2	1	1	1	1	1	1	1	1	1
CO3	U24OE601A.3	1	2	3	2	2	1	1	1	1	1	1	1	1
CO4	U24OE601A.4	1	1	3	2	2	2	1	2	2	2	2	1	1
U24OE601A		1.25	1.75	2.25	1.75	1.5	1.25	1	1.25	1.25	1.25	1.25	1	1
3 – HIGH, 2 – MEDIUM, 1 - LOW														

Course Outcome and SDG Goal Mapping				
CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	identify customer segments and needs, assess customer-problem fit using jobs-to-be-done (jtbd) and customer persona frameworks	**SDG 4**	Quality Education	Develops critical thinking, problem identification, customer-centric analysis, and innovation-oriented learning skills
		SDG 8	Decent Work and Economic Growth	Encourages entrepreneurial thinking and identification of real-world problems that can lead to sustainable economic opportunities
CO2	analyze market opportunities and competitive dynamics, estimate business feasibility and build prototypes/mvps for validating innovative solutions	**SDG 9**	Industry, Innovation and Infrastructure	Promotes innovation, technology-driven problem solving, and development of viable products and services
		SDG 12	Responsible Consumption and Production	Encourages efficient use of resources through prototype validation and iterative product development before large-scale implementation
CO3	develop a lean canvas for a start-up venture by integrating value proposition, customer segments, revenue streams, key metrics and growth strategies	**SDG 8**	Decent Work and Economic Growth	Supports entrepreneurship, start-up creation, employment generation, and sustainable business development
		SDG 9	Industry, Innovation and Infrastructure	Encourages business model innovation and the translation of creative ideas into scalable ventures
CO4	evaluate funding and team-building strategies and develop a scalable, investment-ready venture proposal through financial planning, validation and professional pitching	**SDG 8**	Decent Work and Economic Growth	Enhances entrepreneurial competencies, venture sustainability, and economic value creation
		SDG 17	Partnerships for the Goals	Promotes collaboration among founders, mentors, investors, and stakeholders for successful venture development
		SDG 9	Industry, Innovation and Infrastructure	Facilitates scaling of innovative solutions and commercialization of technology-driven ideas

INNOVATIVE PRODUCT DESIGN & DEVELOPMENT			
Class: B. Tech. – VI -Semester		**Branch:** Common to All	
Course Code:	**U24OE601B-SE&B**	**Credits:**	**3**
Hours/Week (L-T-P- E):	**2-1-0-3**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to…

- **CO1** create the systematic lifecycle of engineering design from customer requirements to technical specifications
- **CO2** choose principles of industrial design, materials science, and ergonomics to optimize product usability
- **CO3** implement the advanced rapid prototyping tools to compress the product development cycle
- **CO4** design and build prototype performance using structural validation, risk analysis, and engineering metrics

UNIT-I	9 Hrs

Introduction to product design engineering: Translating user needs into product design specifications (PDS), Quality function deployment (QFD) and the house of quality framework, Functional decomposition and physical architecture mapping, Regulatory compliance, standards, and safety considerations in product architecture

UNIT-II	9 Hrs

Principles of Industrial Design (ID): Human-centered design and ergonomics (anthropometry), Visual hierarchy, form generation, and product aesthetics, Material selection frameworks (structural, thermal, electrical properties) and manufacturing process mapping (DFM/DFA: Design for manufacturing and assembly), Design semantics and user-interface touchpoints

UNIT-III	9 Hrs

Prototyping strategies: proof-of-concept vs alpha/beta prototypes: Additive manufacturing (3D Printing: FDM, SLA, SLS) and subtractive techniques (CNC machining), Rapid tooling, silicone molding, and vacuum forming, Digital prototyping- Computer-aided design (CAD) modeling, assembly verification, and finite element simulations, Virtual and augmented reality (VR/AR) workflows for product spatial validation

UNIT-IV	9 Hrs

Design of Experiments (DoE) for physical/digital prototypes: Robust design testing and failure analysis, Cost modeling, Bill of Materials (BOM) management, and engineering change orders (ECO), Sustainable engineering: Design for Environment (DFE) and lifecycle evaluation, Preparing the product blueprint for production scaling and supply chain onboarding

Textbook:

1. Karl T Ulrich and Steven D Eppinger, Product Design and Development, Tata McGraw-Hill, 10th Edn, 2012, New Delhi

Reference Book(s):

1. Devdas Shetty, Product Design for Engineers, Cengage Learning, 9th Edn, 2015, Boston
2. AK Chitale and RC Gupta, Product Design and Manufacturing, PHI Learning, 2013, 13th Edn, New Delhi
3. Kevin Otto and Kristin Wood, Product Design: Techniques in Reverse Engineering and New Product Development, Pearson Education, 2001, New Delhi
4. Benjamin W Niebel and Alan B Draper, Product Design & Process Engineering, McGraw-

Hill, 1974, New York

5. Paul Trott, Innovation Management and New Product Development, Pearson Education, 2016, Harlow

Web and Video link(s):

https://nptel.ac.in/courses/112107217, *NPTEL Video Lecture on Product Design and Development by Prof Inderdeep Singh, Professor of Mechanical and Industrial Engineering, IIT Roorkee*

Course Articulation Matrix (CAM):		**U24OE601B - Innovative Product Design & Development**												
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO1**	**PSO 2**
CO1	**U24OE601B.1**	2	2	1	1	1	1	-	1	1	-	1	1	1
CO2	**U24OE601B.2**	1	2	2	2	1	1	1	1	1	-	1	1	1
CO3	**U24OE601B.3**	1	2	3	2	2	1	1	1	1	1	1	1	1
CO4	**U24OE601B.4**	1	1	3	2	2	2	1	2	2	2	2	1	1
U24OE601B		1.25	1.75	2.25	1.75	1.5	1.25	1	1.25	1.25	1.5	1.25	1	1
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	create the systematic lifecycle of engineering design from customer requirements to technical specifications	**SDG 4**	Quality Education	Promotes creative learning, problem-solving, and innovation skills among students
		SDG 9	Industry, Innovation and Infrastructure	Encourages innovative thinking for solving engineering and societal challenges
CO2	choose principles of industrial design, materials science, and ergonomics to optimize product usability	**SDG 3**	Good Health and Well-being	Human-centered design improves usability, safety, and user well-being
		SDG 11	Sustainable Cities and Communities	Supports identification of sustainable and community-oriented solutions
CO3	implement the advanced rapid prototyping tools to compress the product development cycle	**SDG 9**	Industry, Innovation and Infrastructure	Promotes innovation, product development, and technological advancement
		SDG 12	Responsible Consumption and Production	Encourages efficient resource utilization and sustainable product development
CO4	design and build prototype performance using structural validation, risk analysis, and engineering metrics	**SDG 8**	Decent Work and Economic Growth	Supports entrepreneurship, innovation-driven business models, and employability skills
		SDG 9	Industry, Innovation and Infrastructure	Encourages development of practical and scalable engineering solutions
		SDG 17	Partnerships for the Goals	Promotes teamwork, interdisciplinary collaboration, and stakeholder interaction

ENTREPRENEURSHIP			
Class: B. Tech. –VI -Semester		**Branch:** Common to All	
Course Code:	**U24OE601C**	**Credits:**	**3**
Hours/Week (L-T-P- E):	**2-1-0-3**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to…

CO1 :	develop an entrepreneurial mindset and create scalable business concepts through the analysis of opportunities and evaluation of business feasibility
CO2 :	analyze and validate customer needs, market demands, and pain points using structured customer discovery techniques
CO3 :	create students with practical knowledge of business modeling, unit economics, and venture monetization
CO4 :	build a clear roadmap for executing, legally safeguarding, and pitching a new venture

UNIT-I	**9 Hrs**

Introduction to Entrepreneurship: definitions, characteristics, and the evolution of an entrepreneurial ecosystem, Myths vs. Realities of starting up, Types of entrepreneurship (Social, Tech, Lifestyle, and Corporate),

Developing an entrepreneurial mindset: risk-taking, resilience, self-efficacy, and dealing with failure, Identifying personal strengths and alignment with venture archetypes.

UNIT-II	**9 Hrs**

Deep-dive Problem Identification: moving from generic ideas to systemic problems, Root-cause analysis, stakeholder mapping, and ecosystem friction points,

Customer Discovery methodology: conducting ethnographic interviews, building user personas, and mapping customer archetypes, Validating market pain points vs. "nice-to-have" solutions, Value Proposition Canvas framework.

UNIT-III	**9 Hrs**

Designing the business architecture: Introduction to the Lean Canvas and Business Model Canvas (BMC), Revenue streams, pricing strategies, and cost structures,

Fundamentals of Unit Economics: Customer Acquisition Cost (CAC), Lifetime Value (LTV), and break-even analysis, Competitor analysis and establishing a Sustainable Competitive Advantage (Moat), Basics of bootstrapping vs. external funding.

UNIT-IV	**9 Hrs**

Building the Go-To-Market (GTM) strategy: marketing channels, sales funnels, and early user acquisition, Basics of business registration, legal structures (LLP, Pvt Ltd), and intellectual property (IP) awareness, Building an early founding team, equity splitting models, and culture, Final capstone venture pitch preparation: structuring an investor pitch deck.

Textbook(s):

1. Robert D. Hisrich, Michael P. Peters, and Dean A. Shepherd, Entrepreneurship, McGraw-Hill Education, 1st Edn, 2020, New Delhi.

Reference Book(S):

1. Poornima M. Charantimath, Entrepreneurship Development and Small Business Enterprises, Pearson Education, 5th Edn, 2018, New Delhi.
2. Bruce R. Barringer and R. Duane Ireland, Entrepreneurship: Successfully Launching New

Ventures, Pearson, 4th Edn, 2019, New Delhi.
3. Eric Ries, The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation, Crown Business, 2011, New York.
4. S. S. Khanka, Entrepreneurship Development, S. Chand & Company, 2010, New Delhi.
5. Peter Thiel, Zero to One: Notes on Startups, or How to Build the Future, Crown Business, 2014, New York.

Web and Video link(s): .

https://nptel.ac.in/courses/110105067, *NPTEL Video Lecture on Entrepreneurship Essentials by Prof. Rajeev Roy, Entrepreneurship Development Cell, IIT Kharagpur*.

Course Articulation Matrix (CAM):		**U24OE505C/U24OE605C - Entrepreneurship**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO1 1**	**PSO1**	**PSO 2**
CO1	**U24OE601C.1**	2	2	1	1	1	1	-	1	1	-	1	1	1
CO2	**U24OE601C.2**	1	2	2	2	1	1	1	1	1	-	1	1	1
CO3	**U24OE601C.3**	1	2	3	2	2	1	1	1	1	1	1	1	1
CO4	**U24OE601C.4**	1	1	3	2	2	2	1	2	2	2	2	1	1
U24OE601C		**1.25**	**1.75**	**2.25**	**1.75**	**1.5**	**1.25**	**1**	**1.25**	**1.25**	**1.5**	**1.25**	**1**	**1**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	develop an entrepreneurial mindset and create scalable business concepts through the analysis of opportunities and evaluation of business feasibility	SDG 4	Quality Education	Enhances entrepreneurial learning by fostering creativity, critical thinking, and practical problem-solving skills.
		SDG 9	Industry, Innovation and Infrastructure	Promotes innovation and entrepreneurship by encouraging the development of scalable ventures that contribute to industrial and technological growth.
CO2	analyze and validate customer needs, market demands, and pain points using structured customer discovery techniques	SDG 3	Good Health and Well-being	Facilitates the identification and validation of healthcare-related needs, leading to more user-centric and impactful well-being solutions.
		SDG 11	Sustainable Cities and Communities	Supports the development of community-focused innovations by understanding urban challenges and designing solutions aligned with citizens' needs
CO3	create students with practical knowledge of business modeling, unit economics, and venture monetization	SDG 9	Industry, Innovation and Infrastructure	Strengthens innovation ecosystems by enabling the commercialization and scaling of technology-driven ventures.
		SDG 12	Responsible Consumption and Production	Encourages sustainable business practices by integrating resource efficiency, value creation, and responsible production principles into venture planning
CO4	build a clear roadmap for executing, legally safeguarding, and pitching a new venture	SDG 8	Decent Work and Economic Growth	Promotes entrepreneurship and job creation by enabling the successful launch and growth of innovative ventures.
		SDG 9	Industry, Innovation and Infrastructure	Supports innovation-driven enterprises by facilitating the protection, development, and scaling of new technologies and business models
		SDG 17	Partnerships for the Goals	Encourages collaboration with investors, industry partners, mentors, and institutions to strengthen venture growth and impact.

DESIGN STUDIO			
Class: B. Tech. –VI -Semester		**Branch:** Common to All	
Course Code:	**U24OE601D**	**Credits:**	**3**
Hours/Week (L-T-P- E):	**2-1-0-3**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to…

CO1 : deconstruct ambiguous real-world problems into rigorous R&D challenges using patent search and prior-art techniques

CO2 : apply system-level architecture and feasibility models to design technical solutions

CO3 : build and synthesize functional high-fidelity prototypes / MVPs leveraging modern engineering tools

CO4 : validate engineering assumptions via stakeholder co-creation and design an institutional go-to-market plan

UNIT-I	9 Hrs

Foundations of R&D-led entrepreneurship, Identifying deep-tech and high-impact industry problems, Advanced root-cause analysis, Literature review, patent landscaping, and prior art search, Defining the innovation thesis and scientific/technological core, Drafting the initial Product design brief

UNIT-II	9 Hrs

Translating insights into technical concepts, Systematic brainstorming and TRIZ (Theory of inventive problem solving) basics, Technology readiness level (TRL) mapping, Engineering/architectural design and system topology, Value proposition design and business-technical feasibility modeling, The "Napkin Pitch" for technical solutions

UNIT-III	9 Hrs

Rapid prototyping paradigms (Software/Hardware/Service), Formulating the minimum viable product (MVP) core feature matrix, Materials selection and agile development sprints, UI/UX wireframing or hardware schematics, Functional architecture implementation, Risk assessment and failure mode effects analysis (FMEA)

UNIT-IV	9 Hrs

Surface key engineering and market assumptions, Empirical testing protocols, simulation, and data collection, Customer co-creation loops and iterative engineering, Feedback analysis from key industry stakeholders, Creating the product "On-Ramp" strategy (Go-To-Market roadmap, Pilot launch framework, and IP Protection)

Textbook(s):

1. Brian Sullivan, The Design Studio Method: Creative Problem Solving with UX Sketching, Routledge, 2015, New York

Reference Book(s):

1. Elizabeth Boling, James Benedict Brown, Colin M Gray, and Derek Jones, Studio Properties: A Field Guide to Design Education, Yale Press, 2021, New Haven
2. Charles Eastman, W Michael McCracken, and Wendy Newstetter, Design Knowing and Learning: Cognition in Design Education, Elsevier, 2001, Oxford
3. Donald A Schön, Educating the Reflective Practitioner: Toward a New Design for Teaching and Learning in the Professions, Jossey-Bass, 17th Edn, 1987, San Francisco
4. Jerzy Wojtowicz, Virtual Design Studio, Hong Kong University Press, 8th Edn, 1995, Hong Kong

5. Lois Hetland and Ellen Winner, Studio Thinking: The Real Benefits of Visual Arts Education, Teachers College Press, 12th Edn, 2007, New York

Web and Video link(s):

https://nptelacin/courses/124105003, *NPTEL Video Lecture on Understanding Design by Prof Prasad Onkar, Department of Design, IIT Hyderabad*

Course Articulation Matrix (CAM):		**U24OE601D - DESIGN STUDIO**											
CO		**PO1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PSO 1**	**PSO2**
CO1	**U24OE601D.1**	2	2	1	1	1	1	1	1	1	1	1	1	1
CO2	**U24OE601D.2**	1	2	2	2	1	1	1	1	1	1	1	1	1
CO3	**U24OE601D.3**	1	2	3	2	2	1	1	1	1	1	1	1	1
CO4	**U24OE601D.4**	1	1	3	2	2	2	1	2	2	2	2	1	1
U24OE601D		**1.25**	**1.75**	**2.25**	**1.75**	**1.5**	**1.25**	**1**	**1.25**	**1.25**	**1.25**	**125**	**1**	**1**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

Course Outcome and SDG Goal Mapping:

CO–SDG Alignment Matrix				
CO	**Course Outcome**	**Mapped SDGs**		**Justification**
CO1	deconstruct ambiguous real-world problems into rigorous R&D challenges using patent search and prior-art techniques	SDG 4	Quality Education	Promotes experiential and innovation-based learning by equipping learners with problem-solving, research, and intellectual property skills essential for the 21st century
		SDG 9	Industry, Innovation and Infrastructure	Fosters innovation capacity by encouraging the development of novel technologies, strengthening industry-oriented research, and supporting sustainable technological advancement
CO2	apply system-level architecture and feasibility models to design technical solutions	SDG 3	Good Health and Well-being	Supports the design of reliable healthcare technologies and systems that enhance accessibility, efficiency, and overall well-being
		SDG 11	Sustainable Cities and Communities	Facilitates the creation of smart, resilient, and resource-efficient infrastructure solutions that improve urban sustainability and quality of life
CO3	build and synthesize functional high-fidelity prototypes / MVPs leveraging modern engineering tools	SDG 9	Industry, Innovation and Infrastructure	Promotes technological innovation and strengthens engineering capabilities by accelerating product development and industry-relevant solutions
		SDG 12	Responsible Consumption and Production	Encourages efficient resource utilization, iterative design, and sustainable product development practices that minimize waste and optimize production processes
CO4	validate engineering assumptions via stakeholder co-creation and design an institutional go-to-market plan	SDG 8	Decent Work and Economic Growth	Supports entrepreneurship, innovation-driven employment, and sustainable economic growth through market-oriented solution development
		SDG 9	Industry, Innovation and Infrastructure	Strengthens industry-academia innovation ecosystems by facilitating the translation of validated technologies into scalable solutions
		SDG 17	Partnerships for the Goals	Encourages collaboration among academia, industry, government, and end users to co-create impactful and sustainable innovations

DEEP LEARNING			
Class: B Tech VI – Semester		**Branch:** CSE (IoT)	
Course Code:	**U24IN602A**	**Credits:**	**3**
Hours/Week (L-T-P- E):	**2-1-0-3**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1 : apply advanced optimization, regularization, and training strategies to improve deep neural network performance

CO2 : Analyze transfer learning and representation learning models for advanced computer vision applications

CO3 : analyze and implement graph-based and multimodal deep learning models for IoT and intelligent systems

CO4 : analyze efficient, compressed, and explainable deep learning models on edge and embedded devices

UNIT-I	**9 Hrs**

Introduction: Review of deep neural networks, Weight initialization techniques (Xavier, He Initialization), Activation functions (ReLU, Leaky-ReLU, ELU, GELU, Swish), Batch normalization and layer normalization, Dropout and regularization techniques, Learning rate scheduling, Hyperparameter tuning, Loss Functions, Model evaluation metrics, Training best practices

UNIT-II	**9 Hrs**

Deep Learning Optimization and Representation Learning: Gradient descent variants, Momentum , RMSProp, Adam , AdamW, Learning Rate Warm-up, Transfer learning, Fine-tuning strategies, Feature extraction, Self-Supervised learning, Contrastive learning, Metric learning, Siamese networks

UNIT-III	**9 Hrs**

Graph Deep Learning and Advanced Vision Models: Introduction to Graph data, Graph neural networks (GNN), Graph convolutional networks (GCN), Graph attention networks (GAT), GraphSAGE, Knowledge graph embeddings, Deep learning for IoT networks, Multi-modal deep learning, Vision transformers

UNIT-IV	**9 Hrs**

Explainable AI, Edge AI and Model Deployment: Explainable AI (XAI), Model interpretability, SHAP, LIME, Model compression, Quantization, Pruning, Knowledge distillation, Edge AI, TinyML, TensorFlow lite, ONNX Runtime, Deployment on embedded devices, Case studies in IoT

Textbook(s):

1. Ian Goodfellow and Yoshua Bengio and Aaron Courville, *Deep Learning*, 1st edition, MIT Press, 2017*(Chapters 1 ,6 to 12)*
2. Michael Nielsen, *Neural Networks and Deep Learning*, Determination Press, 1st edition, 2013
3. François Chollet, *Deep Learning with Python*, 2nd Edition, Manning Publications, 2021
4. Aurélien Géron, *Hands-On Machine Learning with Scikit-Learn, Keras& TensorFlow*, 3rd Edition, O'Reilly Media, 2023

Reference Book(s):

1. Deng & Yu, *Deep Learning: Methods and Applications*, 1st edition, Now Publisher, USA, 2013
2. Antonio Gulli, Amita Kapoor, Sujit Pal, *Deep Learning with TensorFlow 20 and Keras*, 2nd edition, Mumbai: Packt, 2019
3. Sebastian Raschka, Vahid Mirjalili - *Python Machine Learning*, 2nd edition, Mumbai: Packt, 2019

Web and Video link(s):

https://onlinecoursesnptelacin/noc20_cs62/preview, *NPTEL Video Lecture on Deep Learning by Prof Prabir Kumar Biaswas, Professor of EEE, IIT Kharagpur*

Course Articulation Matrix (CAM):		U24IN602A: DEEP LEARNING												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24IN602A.1	2	2	2	1	2	1	1	1	1	1	1	2	2
CO2	U24AI602A.2	2	2	1	2	2	1	1	1	1	1	1	2	2
CO3	U24AI602A.3	2	2	1	2	2	1	1	1	1	1	1	2	2
CO4	U24AI602A.4	2	2	2	3	2	1	1	1	1	1	1	2	2
U24IN602A		2	2	1.5	2	2	1	1	1	1	1	1	2	2
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	apply deep learning fundamentals and regularization techniques for tuning model performance	SDG9	Industry, Innovation and Infrastructure	Deep learning fundamentals and optimization techniques enable the development of efficient and scalable AI models, supporting innovation in industrial applications and intelligent systems
CO2	build and analyze convolutional neural network models for image recognition	SDG3	Good Health and Well-being	CNN-based image recognition is widely used in medical imaging applications such as disease diagnosis and detection, improving healthcare quality and early intervention
CO3	apply recurrent and recursive neural network architectures for handling long-term dependencies	SDG9	Industry, Innovation and Infrastructure	RNN and advanced architectures support applications like speech recognition, predictive analytics, and automation systems, contributing to technological advancement and smart infrastructure
CO4	build deep learning models for computer vision, speech, and natural language processing applications	SDG11	Sustainable Cities and Communities	Deep learning applications such as smart surveillance, traffic management, and intelligent communication systems contribute to building safer, efficient, and sustainable urban environments

FUNDAMENTALS OF CYBER SECURITY TOOLS			
Class: B Tech VI – Semester		**Branch:** CSE (IOT)	
Course Code:	U24IN602B	**Credits:**	**3**
Hours/Week (L-T-P- E):	**2-1-0-3**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1: understand cyber security fundamentals, threats, vulnerabilities, and system protection mechanisms

CO2: analyse network security monitoring and defence mechanisms for secure communication

CO3: apply vulnerability assessment and security auditing techniques for protecting computing systems

CO4: identify IoT security challenges and recommend suitable cyber defence strategies

UNIT-I	9 Hrs

Introduction to Cyber Security: Introduction to cyber security, Information security principles, CIA Triad, Threats and vulnerabilities

Cyber Attacks and Access Control: Types of cyberattacks, Authentication and authorization, Access control mechanisms

Malware and Risk Management: Malware fundamentals, Security policies, Risk management concepts

Operating System and Linux Security: Operating system security basics, Linux fundamentals for security administration, Basic security administration practices

UNIT-II	9 Hrs

Network Security Fundamentals: Network security fundamentals, Secure communication concepts, Domain Name System (DNS) security basics

Firewalls and Intrusion Detection: Firewalls and packet filtering, Intrusion detection and prevention Systems

VPN and Wireless Security: Virtual Private Networks (VPNs), Wireless network protection techniques

Network Monitoring and Analysis: Network traffic analysis, Log monitoring and event analysis

UNIT-III	9 Hrs

Vulnerability Assessment: Vulnerability assessment concepts, Security auditing techniques

Secure System Configuration: Secure system configuration, Patch management techniques

Web and Password Security: Web application basics, Secure password policies

Backup and Endpoint Security: Data backup and recovery mechanisms, Endpoint security concepts, Cloud security fundamentals

UNIT-IV	9 Hrs

Fundamentals of IoT Security: Introduction to IoT security, IoT Architecture and security challenges

Secure IoT Communication: Secure IoT communication protocols, Sensor and embedded device security

Device Authentication and Privacy: Smart device authentication, IoT Data privacy and protection, Mobile device security

Cyber Defence and Governance: Cyber defence strategies, Incident response and security best practices, Security governance and cyber laws

Textbook(s):

1. Charles J Brooks, Christopher Grow, Philip Craig and Donald Short, *Cyber Security Essentials*, 2nded,Wiley, 2023 *(Chapters 1 to 12)*
2. William Stallings and Lawrie Brown, *Computer Security: Principles and Practice*, 5th ed, Pearson Education, 2024 *(Chapters 1 to 11, 14 to 18)*
3. Michael E Whitman and Herbert J. Mattord, *Principles of Information Security*, 7th ed, Cengage Learning, 2022 *(Chapters 1 to 10)*
4. William Stallings, *Network Security Essentials: Applications and Standards*, 7th ed, Pearson Education, 2021 *(Chapters 1 to 9)*
5. Occupy The Web, *Linux Basics for Hackers*, No Starch Press, 2018 *(Chapters 1 to 9)*

Reference Book(s):

1. Shon Harris and Fernando Maymi, *CISSP All-in-One Exam Guide*, 9th ed, McGraw-Hill Education, 2021
2. David Kim and Michael G Solomon, *Fundamentals of Information Systems Security*, 4th ed, Jones & Bartlett Learning, 2021
3. Brian Russell and Drew Van Duren, *Practical Internet of Things Security*, 2nd ed, Packt Publishing, 2023
4. Fei Hu, *Security and Privacy in Internet of Things (IoTs): Models, Algorithms and Implementations*, CRC Press, 2021
5. James Turnbull, *The Logstash Book*, Turnbull Press, 2019

Web and Video link(s):

1. https://nptelacin/courses/106106248: *NPTEL Video Lecture on Cyber Security and Privacy, by Prof Saji K Mathew, IIT Madras*
2. https://nptelacin/courses/106104467: *NPTEL Video Lecture onPractical Cyber Security for Cyber Security Practitioners, by Prof Sandeep K Shukla IIT Kanpur*
3. https://nptelacin/courses/129106894: *NPTEL Video Lecture onInternet Crimes and Cyber Security, by Prof KVK Santhy Prof B Md Irfan, NALSAR University of Law*

Course Articulation Matrix (CAM):		**U24IN602B : FUNDAMENTALS OF CYBER SECURITY TOOLS**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24IN602B.1**	3	2	2	2	2	1	-	-	-	-	-	1	2
CO2	**U24IN602B.2**	3	3	2	2	3	1	-	-	-	-	-	1	2
CO3	**U24IN602B.3**	3	2	2	2	3	2	1	-	1	-	-	1	2
CO4	**U24IN602B.4**	3	2	2	2	2	2	1	-	1	-	-	1	3
U24IN602B		**3**	**2.25**	**2**	**2**	**2.5**	**1.5**	**1**	**-**	**1**	**-**	**-**	**1**	**2.25**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	understand cyber security fundamentals, threats, vulnerabilities, and system protection mechanisms	SDG 9	Industry, Innovation and Infrastructure	Cyber security fundamentals support the development of secure digital infrastructure and reliable computing systems for modern industries and communication networks
CO2	analyse network security monitoring and defence mechanisms for secure communication	SDG 9	Industry, Innovation and Infrastructure	Network security and defense mechanisms improve resilience and protection of communication infrastructure against cyber threats and attacks
CO3	apply vulnerability assessment and security auditing techniques for protecting computing systems	SDG 16	Peace, Justice and Strong Institutions	Vulnerability assessment and security auditing ensure digital trust, cybercrime prevention, and protection of institutional information systems
CO4	identify iot security challenges and recommend suitable cyber defense strategies	SDG 9	Industry, Innovation and Infrastructure	IoT security and cyber defense strategies support secure smart systems, connected devices, and reliable digital infrastructure for future technologies

STATISTICAL FUNDAMENTALS			
Class: B.Tech. VI-Semester		**Branch:** CSE(IoT)	
CourseCode:	**U24IN602C**	**Credits:**	**3**
Hours/Week(L-T-P-E):	**2-1-0-3**	**CIE:**	**60 %**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40 %**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1: apply linear algebra and multivariate calculus concepts to solve real-world situations

CO2 : analyze the data using various statistical measures and probability distributions

CO3 : apply exact sampling distributions in testing of hypothesis

CO4 : analyze dimensionality reduction with PCA and optimize the function using various methods of optimization

UNIT-I	**9 Hrs**

Linear algebra: Introduction to vectors, Vector space and subspace, Linear combination and span, Linear independence and dependence, Basis vectors, Linear transformations, Null space and range of linear map and Rank-nullity theorem

Matrix decompositions: LU decomposition, Gram Schmidt process, QR decomposition, Singular value decomposition and properties, Norms and Matrix approximations

Multivariate calculus: Partial differentiation and gradient, Jacobian matrix, Gradients of matrices, Hessian matrix, Convex sets, Convex functions and multivariate Taylor series

UNIT-II	**9 Hrs**

Probability: Basic rules and axioms, Dependent and independent events,Conditional probability, Baye's theorem

Random variables: Discrete and continuous random variables, Expectation and variance

Distributions: Binomial, Poisson and Normal distributions

Joint probability distributions: Joint probability mass and density function, Marginal probability mass and density functions and Covariance

UNIT-III	**9 Hrs**

Statistics: Measures of Central tendency, Measures of dispersion, Skewness, Kurtosis, Correlation coefficient of correlation, Linear regression,Curve fitting and method of least squares

Sampling:Types of Sampling, Population, Sample, Parameter, Statistics, Sampling distribution of means (σ-known)and **e**stimation

Testof hypothesis: Procedure for testing of hypothesis, Test of significance of a single mean and difference of means-Large samples, Test of significance of a single Mean and difference of means-small samples, Paired sample t-test, F-test, F-test for equality of population variances, Chi square test, Chi-square test for goodness of fit and One-way ANOVA

UNIT-IV	**9 Hrs**

Dimensionality Reduction with Principal Component Analysis: Problem setting, Maximum variance perspective, Projection perspective, Eigenvector computation and low-rank approximations, PCA in high dimensions, Key Steps of PCA in practice and latent variable Perspective

Optimization: Optimization problem, Unconstrained optimization and constrained optimization

Unconstrained optimization: Gradient Descent method, Conjugate gradient method and Newton's method,Penalty function method

Constrained optimization: Lagrange's method and Kuhn-Tucker conditions

Textbook(s):

1. SC Gupta VK Kapoor, *Fundamentals of Mathematical Statistics*, 10th ed, New Delhi: Sultan Chand &Sons Educational Publishers, 2010
2. Marc Peter Deisenroth, A Aldo Faisal, and Cheng Soon Ong, *Mathematics for Machine Learning*, 1st ed, UK: Cambridge University Press, 2020
3. Bernard KolmanandDavid RHill,*Introductory linear algebra an applied first course*, London, UK: Pearsoneducation
4. SSRao, *Engineering Optimization theory and practice*, 4th ed, Hoboken, New Jersey John Wiley & Sons, Inc, 2009

Reference Book(s):

1. G Strang, *Introduction to Linear Algebra,* 6th ed, MA, USA: Wellesley-Cambridge Press, 2023
2. BLS Prakasa Rao, *A first course in Probability and statistics*, 1st ed, Singapore: World Scientific Publishing Co Pvt Ltd, 2009
3. S P Gupta, *Statistical Methods*, 46th ed, New Delhi: Sultan Chand& Sons, 2021
4. JCPant, *Introduction to Optimization (OperationsResearch)*, 7th ed, New Delhi: JainBrothers, 2008

Web and Video link(s):

1. https://wwwyoutubecom/watch?v=JO9jNe6BemE&list=PLLy_2iUCG87D1CXFxE-SxCFZUiJzQ3IvE:

   NPTEL Video Lecture on ESSENTIAL MATHEMATICS FOR MACHINE LEARNING/Prof SKGupta and Prof Sanjeev kumar /IIT Roorkee
2. https://wwwyoutubecom/watch?v=r1sLCDA-kNY&list=PL46B9EA2CFEB51241:

   NPTEL Video Lecture on Introduction to the Theory of Probability/ProfMChakraborty /IIT Kharagpur

Course Articulation Matrix (CAM):		**U24IN602C: STATISTICAL FUNDAMENTALS**											
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	**U24IN602C.1**	2	2	1	1	-	-	-	1	1	-	1	2	1
CO2	**U24IN602C.2**	2	2	1	1	-	-	-	1	1	-	1	2	1
CO3	**U24IN602C.3**	2	2	1	1	-	-	-	1	1	-	1	2	1
CO4	**U24IN602C.4**	2	2	1	1	-	-	-	1	1	-	1	2	1
U24IN602C		**2**	**2**	**1**	**1**	**-**	**-**	**-**	**1**	**1**	**-**	**1**	**2**	**1**

CO–SDG Alignment Matrix				
CO	**Course Outcome**	**Relevant SDG(s)**	**SDG Description**	**Justification**
CO1	apply linear algebra and multivariate calculus concepts to solve real-world situations	SDG 4, SDG 9	Quality Education, Industry, Innovation and Infrastructure	Develops strong mathematical foundations and analytical skills required for solving engineering problems and fostering innovation
CO2	analyze the data using various statistical measures and probability distributions	SDG 4, SDG 9, SDG 17	Quality Education, Industry, Innovation and Infrastructure, Partnerships for the Goals	Enables data-driven analysis and decision-making, supporting research, industrial applications, and collaborative data sharing
CO3	apply exact sampling distributions in testing of hypothesis	SDG 3 , SDG 4, SDG 9	Good Health and Well-being, Quality Education, Industry, Innovation and Infrastructure	Statistical hypothesis testing supports evidence-based decision-making in healthcare, research, quality control, and engineering
CO4	analyze dimensionality reduction with pca and optimize the function using various methods of optimization	SDG 9, SDG 11, SDG 12	Industry, Innovation and Infrastructure, Sustainable Cities and Communities, Responsible Consumption and Production	Optimization and dimensionality reduction improve the efficiency of AI, IoT, and industrial systems, enabling sustainable resource utilization

IoT FRAMEWORKS			
Class: B. Tech. VI–Semester		**Branch:** CSE (IoT)	
Course Code:	**U24IN603**	**Credits:**	**3**
Hours/Week (L-T-P-E):	**2-1-0-3**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1 : understand IoT architecture, design principles, and fundamental frameworks

CO2 : apply Node-RED to design, create, and deploy IoT workflows using nodes, wiring, and functions for data acquisition and processing

CO3 : develop advanced mobile IoT applications using Flutter by integrating Firebase services, push notifications, alerts, and real-time data visualization dashboards

CO4 : design secure and scalable IoT systems with appropriate frameworks

UNIT-I	9 Hrs

Overview of IoT Frameworks: Introduction, Characteristics, Evolution from device-centric to platform-centric IoT, Limitations of traditional IoT architectures, open-source platforms, popular frameworks

Classification of Frameworks: Device Centric, cloud centric, Edge centric, conceptual framework, IBM framework, Protocols, Interoperability challenge

IoT Data Flow and Processing: Data acquisition, on-site and cloud-based processing models, edge-assisted processing concepts

UNIT-II	9 Hrs

Introduction to Node-RED: Features and advantages, Flow-based programming concept,Architecture and components

Working with Node-RED: Installation and setup, Nodes, flows, and wiring, Function nodes and data processing

Integration in Node-RED: MQTT integration and real-time communication, HTTP and REST API integration, Connecting sensors and cloud platform

Dashboard and Visualization: Creating dashboards - charts, gauges, UI elements, Real-time monitoring systems, Advances - Data storage and database integration, Event-driven flows and automation, Security considerations in Node-RED

UNIT-III	9 Hrs

Introduction to Mobile IoT Applications: Role of mobile applications in IoT ecosystems, Communication between IoT systems and mobile users

Introduction to Flutter: Architecture of Flutter, Dart programming basics, Setting up development environment, UI Development in Flutter,

Integration with IoT Systems: REST API integration, MQTT integration in Flutter,Firebase integration, Push notifications and alerts, Real-time data visualization, Security in mobile IoT apps

UNIT-IV	9 Hrs

End-to-End IoT Workflow Design: Device integration, data acquisition, communication flow, edge-to-cloud data processing, dashboard and mobile application integration

Emerging Trends in IoT Frameworks: Introduction to Edge AI, TinyML, Digital Twins, Artificial Intelligence in IoT (AIoT), and Blockchain-enabled IoT frameworks

Case Studies: Healthcare IoT, Smart Agriculture, Gas Monitoring, smart home automation
Textbook(s): 1. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, Wiley, 2nd edition, 2012, United Kingdom (Chapters 1 to 6, 8, 10 to 12) 2. Rajkumar Buyya, Amir Vahid Dastjerdi, Internet of Things: Principles and Paradigms, Springer, 1st edition, 2016, Switzerland (Chapters 2 to 6, 8, 10 to 13)
Textbook(s): 1. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, Wiley, 2nd edition, 2012, United Kingdom (Chapters 1 to 6, 8, 10 to 12) 2. Rajkumar Buyya, Amir Vahid Dastjerdi, Internet of Things: Principles and Paradigms, Springer, 1st edition, 2016, Switzerland (Chapters 2 to 6, 8, 10 to 13)
Reference Book(S): 1. Daniel Minoli, Building the Internet of Things with IPv6 and M2M Communications, Wiley, 1st edition, 2013, United States (Chapters 3 to 8, 10 to 12) 2. Brij B Gupta, Internet of Things Security: Fundamentals, Techniques and Applications, De Gruyter, 1st edition, 2017, Germany (Chapters 2 to 6, 8 to 10)
Web and Video link(s): 1. https://wwwyoutubecom/watch?v=WSnZ0RCDGfE 2. https://wwwyoutubecom/watch?v=Q89oqK_nzFg&list=PLhr1KZpdzukf3Ohr9eTB3eQlawDT5tHGL

Course Articulation Matrix (CAM):		U24IN603 : IOT FRAMEWORKS												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24IN603.1	1	2	2	1	3	-	1	-	1	1	2	2	2
CO2	U24IN603.2	2	2	2	2	3	-	1	-	1	1	2	3	3
CO3	U24IN603.3	2	2	2	2	3	-	1	-	1	1	2	3	3
CO4	U24IN603.4	2	2	3	3	3	-	1	-	1	1	2	3	3
U24IN603		1.75	2	2.25	2	3	-	1	-	1	1	2	2.75	2.75
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	apply image pre-processing techniques	SDG9	Industry, Innovation and Infrastructure	Frequency domain filtering and restoration techniques improve image quality in industrial and satellite imaging systems, supporting reliable infrastructure monitoring and innovation
CO2	apply frequency domain filtering, restoration and reconstruction techniques	SDG9	Industry, Innovation and Infrastructure	Frequency domain filtering and restoration techniques improve image quality in industrial and satellite imaging systems, supporting reliable infrastructure monitoring and innovation
CO3	apply node-red to design, create, and deploy iot workflows using nodes, wiring, and functions for data acquisition and processing	SDG11	Sustainable Cities and Communities	Image segmentation and morphological analysis enable applications like traffic analysis, surveillance, and urban monitoring, contributing to safer and smarter cities
CO4	apply feature extraction and classification techniques	SDG9	Industry, Innovation and Infrastructure	Feature extraction and classification form the backbone of AI-driven systems such as autonomous vehicles, industrial automation, and smart analytics, fostering technological innovation

INDUSTRIAL IOT			
Class: B. Tech. VI – Semester		**Branch:** CSE (IoT)	
Course Code:	U18IN604	**Credits:**	**3**
Hours/Week (L-T-P- E):	**2-1-0-3**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1 : understand the concepts of Industry 4.0, Industrial IoT ecosystems, industrial architectures, and business models used in smart industries

CO2 : analyze industrial communication technologies, industrial data acquisition systems, and smart manufacturing workflows used in IIoT environments

CO3 : apply embedded controllers, industrial analytics, predictive maintenance, and smart traffic management techniques in industrial IoT applications

CO4 : evaluate real-world Industrial IoT case studies like smart industrial applications in healthcare, transportation, mining, smart cities, and environmental monitoring

UNIT-I	9 Hrs

Introduction to Industry 4.0: Evolution of industrial automation, drivers of Industry 4.0, smart manufacturing concepts, cyber-physical production systems, impact of Industry 40 on industries

Industrial Internet of Things (IIoT): Industrial IoT ecosystem, industrial sensing and automation, industrial process monitoring and control

IIoT Business Models and Architectures: Business models in IIoT, Industrial Internet Reference Architecture (IIRA), RAMI 4.0 architecture, industrial interoperability concepts, key performance indicators in industrial systems

UNIT-II	9 Hrs

Embedded Controllers in IIoT: ARM Cortex controllers, low-power industrial embedded systems, real-time processing, sensor and actuator interfacing in industrial applications

Industrial CAN Communication Systems: CAN protocol architecture, CAN bus communication, CAN message frame structure, arbitration mechanism, error detection and handling in CAN, real-time industrial communication in IIoT systems

Smart Traffic Management System: Architecture, vehicle detection and traffic density analysis, embedded processing for traffic control, adaptive traffic signal management, and emergency vehicle prioritization

UNIT-III	9 Hrs

Industrial Communication Technologies: Foundation Fieldbus, Profibus, Modbus, Interbus, Bitbus, CC-Link, DeviceNet, HART, WirelessHART, ISA10011.a, LonWorks, DigitalSTROM, LoRa and LoRaWAN, Industrial wired and wireless communication technologies, Interoperability in industrial environments, Recent and emerging industrial communication technologies

Industrial Data Acquisition Systems: PLC, SCADA, Distributed Control Systems (DCS), industrial monitoring and supervisory control

Industrial Analytics and Predictive Systems: Industrial data analytics concepts, predictive maintenance basics, condition monitoring systems, anomaly detection in industrial environments

Smart Manufacturing Technologies: Smart factories, digital manufacturing systems, lean manufacturing, industrial automation workflows, inventory management system
UNIT-IV **9 Hrs**
Industrial IoT Case Studies: Predictive maintenance in manufacturing industries, Internet of Medical things (IoMT), V2V communication, Smart home automation coal mining industry, Intelligent drainage monitoring system, Water management systems, Air quality monitoring, Weather monitoring
Textbook(s): 1. SudipMistra, Chandan Roy, Anandarup Mukharjee, *Introduction to Industrial Internet of Things and Industry 4.0*, Oxon: CRC press, Taylor & Francis group, 2021 (Chapters: 1,2,3,4,5,6,7,8,9,10) 2. A Suresh, Malarvizh Nandagopal, Pethuru Raj, EA Neeba, Jenna-Wei Lin, *Indutrial IoT Application Architecture and Use Cases*, Sulte: CRC Press, Taylor & Francis group, 2020, (Chapter:11)
Reference Book(S): 1. Alasdair Gilchrist, Industry 40: The Industrial Internet of Things, Thailand: Apress, 2016
Web and Video link(s): *https://wwwyoutubecom/watch?v=p7kYStiASLo&list=PLbRMhDVUMngdcLdH4-YF1uJI4IuhcDZPR*, NPTEL Video Lecture on Industrial IoT by Prof. Sudip Mistra, Professor of CSEt, IIT Kharagpur

Course Articulation Matrix (CAM):		**U24IN604 : INDUSTRIAL IOT**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24IN604.1**	3	3	1	2	2	2	1	-	2	–	–	3	3
CO2	**U24IN604.2**	3	3	2	1	3	2	1	–	2	–	–	3	3
CO3	**U24IN604.3**	3	3	3	2	3	1	2	-	2	–	–	3	3
CO4	**U24IN604.4**	3	3	2	2	2	2	3	-	2	1	–	3	3
U24IN604		**3**	**3**	**2**	**1**	**3**	**1**	**2**		**1**	**1**	**–**	**3**	**3**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	understand the concepts of industry 4.0, industrial iot ecosystems, industrial architectures, and business models used in smart industries	SDG 9	Industry, Innovation and Infrastructure	Understanding Industry 40 and IIoT architectures provides the foundation for smart industrial innovation, digital transformation, and sustainable industrial infrastructure
CO2	analyze industrial communication technologies, industrial data acquisition systems, and smart manufacturing workflows used in iiot environments	SDG 9	Industry, Innovation and Infrastructure	Industrial communication and smart manufacturing technologies improve industrial efficiency, automation, reliability, and innovation in modern production systems
CO3	apply embedded controllers, industrial analytics, predictive maintenance, and smart traffic management techniques in industrial iot applications	SDG 11	Sustainable Cities and Communities	Smart traffic systems, predictive analytics, and intelligent industrial control contribute to sustainable urban infrastructure, efficient transportation, and optimized resource utilization
CO4	evaluate real-world industrial iot case studies like smart industrial applications in healthcare, transportation, mining, smart cities, and environmental monitoring	SDG 3, SDG 11, SDG 13	Good Health and Well-being, Sustainable Cities and Communities, Climate Action	IIoT applications in healthcare, smart cities, mining safety, transportation, and environmental monitoring support public well-being, sustainable urban development, and environmental protection

DEVOPS			
Class: B. Tech. VI – Semester		**Branch:** CSE (IoT)	
Course Code:	**U24IN605**	**Credits:**	**3**
Hours/Week (L-T-P- E):	**2-1-0-3**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1 : apply version control concepts using Git and remote repository management using GitHub for collaborative software development workflows

CO2 : understand build automation and project management using Apache Maven, Gradle, and npm

CO3 : implement containerization and orchestration using Docker and Kubernetes

CO4 : design and implement CI/CD pipelines using Jenkins by integrating automation scripts and deployment strategies

UNIT-I	9 Hrs

DevOps Fundamentals: Introduction, Evolution - Software development life cycle (SDLC) vs agile methodology, DevOps lifecycle and practices, Challenges and Applications

Version Control System (VCS): Introduction, Types, Git-Introduction, Features, architecture and workflow, Basic commands

Git Branching: Basic Branching and Merging, Branch management, Branching workflows, remote branches, Rebasing

Remote Repositories: Introduction, Types, GitHub- Introuction, Creating github repository

UNIT-II	9 Hrs

LINUX Basic and Admin: Learning the shell, Navigation, Manipulating files and directories, Working with commands, Permissions, Processes, Introduction to shell scripting

Introduction to Build Automation: Need for Build Automation, Maven-Introduction, architecture,Lifecycle, Project management-Project object model (POM) ,Understanding pomxml, Maven coordinates, Executing Maven builds ,Maven Plugins and Dependency management, Other build tools-Introduction to gradle and npm

UNIT-III	9 Hrs

Docker: Introduction, Architecture, Containers vs virtual machines, Basic workflow, Components

Docker Images: Building custom images, Image tagging, Pushing images to docker hub

Dockerfile: Instructions, Writing dockerfile, Building custom images

Docker Compose: Key Benefits, The docker-composeyml file, Basic commands, Networking, Troubleshooting , Debugging

Basics of Kubernetes: Introduction to kubernetes, Architecture, and Components of kubernetes

UNIT-IV	9 Hrs

Continuous Integration and Continuous Deployment(CI/CD) Concepts: Introduction, Importance of automation, Advantages, CI/CD workflow, deployment strategies

Jenkins: Introduction, architecture, Jenkins setup - Installation (windows / docker), Dashboard & configuration, Plugins management

Jenkins Pipelines: Freestyle project, Declarative and scripted pipelines, Writing Jenkins file,

Pipeline parameters and environment variables, Handling build artifacts, Integrating jenkins with docker, Build triggers (poll SCM, webhook)

Textbook(s):

1. Mikael Krief, Learning DevOps, Second Edition,2022(chapter 1,7,10)
2. William Shotts, The Linux Command Line, A Complete introduction, 2nd edition 2019 (chapter 1 to 10)
3. Scott Chacon, Ben Straub, everything you need to know about git, Pro Git, 2025 Dec 12 (chapter1 to3)
4. Bobby Iliev, Introduction to Docker, 2024 August 19 (chapter 1 to 8)

Reference Book(s):

1. Forsgren N, Humble J, Kim G Accelerate: The science of lean software and devops: Building and scaling high performing technology organizations IT Revolution, 2018 Mar 27
2. Nickoloff J, Kuenzli S Docker in action Simon and Schuster, 2019 Oct 28

Web and Video link(s):

1. https://wwwyoutubecom/playlist?list=PL9ooVrP1hQOE5ZDJJsnEXZ2upwK7aTYiX
2. https://wwwyoutubecom/watch?v=Ou9j73aWgyE

Course Articulation Matrix (CAM):		U24IN605 : DEVOPS												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24IN605.1	3	2	2	1	2	1	1	-	1	-	1	2	2
CO2	U24IN605.2	3	2	2	2	3	1	1	-	1	-	1	2	2
CO3	U24IN605.3	3	2	2	2	3	1	1	-	1	-	1	2	2
CO4	U24IN605.4	3	2	2	2	3	1	1	-	1	-	1	2	2
U24IN605		3	2	2	1.25	2.75	1	1	-	1	-	1	2	2
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	apply version control concepts using Git and remote repository management using GitHub for collaborative software development workflows	SDG 4	Ensure inclusive and equitable quality education and promote lifelong learning	The course introduces version control and collaborative development practices using Git and GitHub, equipping students with industry-relevant skills and promoting continuous learning aligned with modern software development workflows
CO2	understand build automation and project management using Apache Maven, Gradle, and npm	SDG 9	Build resilient infrastructure and foster innovation	The use of build automation tools (Maven, npm) and Nodejs scripting enables efficient software development workflows and supports scalable and innovative digital infrastructure
CO3	implement containerization and orchestration using Docker and Kubernetes	SDG 9	Build resilient infrastructure and promote sustainable industrialization	Containerization and orchestration using Docker and Kubernetes enable scalable, reliable, and efficient deployment of applications, forming the backbone of modern cloud infrastructure
CO4	design and implement CI/CD pipelines using Jenkins by integrating Nodejs applications, automation scripts, and deployment strategies	SDG 8	Promote sustained, inclusive economic growth and productive employment	CI/CD automation using Jenkins enhances software delivery efficiency, reduces manual effort, and improves productivity, contributing to modern digital workforce practices and economic growth

UNIVERSAL HUMAN VALUES - II			
Class: B. Tech. VI – Semester		**Branch:** All Branches	
Course Code:	**U24IK606A**	**Credits:**	**1**
Hours/Week (L-T-P- E):	**2-0-0-2**	**CIE:**	**60%**
Total Number of Teaching Hours:	**24 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1: describe harmony within the individual by understanding the distinct roles of the self and the body

CO2 : analyze values in human relationships and apply the principles of justice, mutual happiness, and harmony in family and society

CO3: explain the interconnectedness of nature and existence and evaluate the concept of coexistence and mutual fulfilment among all orders of nature

CO4: apply professional ethics and sustainable practices in engineering and professional activities for societal and environmental well-being

UNIT-I	**6 Hrs**

Course Introduction - Need, Basic guidelines, Content and Process for value education **Self-exploration**: Natural acceptance and Experiential validation, Basic human aspirations, Right understanding, Relationship and Physical facility, fulfilment of aspirations, Understanding happiness and prosperity, Harmony at various levels

Understanding Harmony in the Human Being: Harmony in myself, Understanding human being, Understanding the harmony of self with the body, Harmony in self, Health, Program for self and health

UNIT-II	**6 Hrs**

Understanding Harmony in the Family: Harmony in human - human Relationship, Understanding values in human-human relationship, Meaning of Justice (universal values in relationships), Mutual happiness

Understanding Harmony in the Society: Harmony in the society, Visualizing a universal harmonious order in society- Undivided society, Universal order- from family to world family

UNIT-III	**6 Hrs**

Understanding Harmony in the Nature: Whole existence as coexistence, Understanding the harmony in the Nature, Interconnectedness and mutual fulfilment among the four orders of nature, Recyclability and Self-regulation in nature

Understanding Harmony in the Existence: Understanding existence as co-existence of mutually interacting units in all- pervasive space, Holistic perception of harmony at all levels of existence

UNIT-IV	**6 Hrs**

Professional Ethics: People friendly and eco-friendly production systems, Appropriate technologies and management patterns

Case Studies: Case studies of typical holistic technologies, Management models and production systems

Textbook:

1. R. R. Gaur, R. Sangal and G. P. Bagaria, *Human Values and Professional Ethics*, New Delhi Excel Books, 2010

Reference Book(s):

1. A.Nagaraj, *Jeevan Vidya: Ek Parichaya*, Raipur: Jeevan Vidya Prakashan, Amar kantak, 2018
2. A.N.Tripathi, *Human Values*, New Age International Publisher, 3rded., NewDelhi, 2019
3. M.Govindrajran, S.Natrajan & V.S.Senthil Kumar, *Engineering Ethics (includes Human Values)*, PHI Learning Pvt Ltd, 12thed., Haryana, 2011
4. Jayshree Suresh, B S Raghavan, *Human Values & Professional Ethics*, 4thed., S.Chand & Co. Ltd., New Delhi, 2012

AdditionalResources:

1. A set of DVDs containing- Video of Teachers "Orientation Program-PPTs of Lectures and Practice Sessions (*Audio-visual material for use in the practice sessions*)

Web and Video link(s):

1. https://fdp-siaicte-indiaorg/UHVIIphp

Course Articulation Matrix		U24IK606B UNIVERSAL HUMAN VALUES - II												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24IK606B.1	2	1	-	-	-	1	-	3	-	-	-	1	1
CO2	U24IK606B.2	1	2	-	-	-	3	-	3	2	2	-	1	1
CO3	U24IK606B.3	1	2	-	-	-	2	3	2	-	-	-	1	1
CO4	U24IK606B.4	1	2	-	-	-	3	3	3	2	2	3	1	1
U24IK606B		**1.25**	**1.75**	-	-	-	**2.25**	**3**	**2.75**	**2**	**2**	**3**	**1**	**1**

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	describe harmony within the individual by understanding the distinct roles of the self and the body	SDG 4	Quality Education	Develops self-awareness, values, ethical thinking, and holistic education for responsible citizenship
CO2	analyze values in human relationships and apply the principles of justice, mutual happiness, and harmony in family and society	SDG 16	Peace, Justice and Strong Institutions	Promotes justice, mutual respect, harmonious relationships, and peaceful societies
CO3	explain the interconnectedness of nature and existence and evaluate the concept of coexistence and mutual fulfillment among all orders of nature	SDG 13, SDG 15	Climate Action, Life on Land	Enhances understanding of ecological balance, coexistence, environmental sustainability, and conservation
CO4	apply professional ethics and sustainable practices in engineering and professional activities for societal and environmental well-being	SDG 9, SDG 12	Industry, Innovation and Infrastructure, Responsible Consumption and Production	Encourages ethical professional practices, sustainable technologies, and environmentally responsible production systems

TECHNICAL ENGLISH			
Class: B.Tech. VI–Semesters		**Branch:** Common to all Branches	
CourseCode:	**U24MH607**	**Credits:**	**1**
Hours/Week(L-T-P-E):	**0-0-2-2**	**CIE:**	**100%**
Total Number of Teaching Hours:	**24Hrs**	**ESE:**	**-**

Course Learning Outcomes(COs)

After completion of this course, thestudents should be able to,

CO1: develop effective listening, speaking, reading, and writing skills by understanding native-speaker conversations and expressing ideas clearly and confidently using appropriate vocabulary, while maintaining fluency, coherence, and accurate pronunciation

CO2: enhance communication and professional writing skills through podcast comprehension, group discussions, resume writing, and email writing

CO3: develop the ability to comprehend reading texts and conversations of both native and non-native speakers, interpret visual information, and produce clear and well-structured technical reports

CO4: develop the ability to perform effectively in interviews and deliver presentations with clarity of speech and appropriate pronunciation and accent

Activity-1	**2hrs**

Phonetic Foundations, Authentic Audio-Visual Comprehension & Vocabulary Enhancement: SpeechSounds- Phonemes (Vowels and consonant sounds),word stress, syllables - their role and importance in spoken English

Authentic Audio-Visual Comprehension: Movie Clips - Screening of a short native-speaker clip - context comprehension, focus attention on accent features and key expressions, **Vocabulary:**WordFormation-Prefixes-Suffixes

Activity: Practice pronunciation through Read-Record-Reflect, analyze audio-visual content for comprehension and expression usage

Activity- 2	**2hrs**

Story Narration, Writing Skills and Vocabulary Enhancement- Narrative structure (beginning, build-up, climax, conclusion), Cohesive devices, Voice modulation & expression

Writing: Principles of Paragraph Writing- Importance of Coherencein Writing-Cause and Effect Paragraphs

Vocabulary: Synonyms and antonyms

Activity: Narrate structured stories with peer interaction, Read-Record-Reflect storytelling activity for pronunciation and expression enhancement, Write a coherent cause and effect paragraph, Vocabulary practice exercises on synonyms and antonyms

Activity - 3	**2hrs**

Reading Comprehension, Vocabulary Enhancement & Elocution Skills- Reading Comprehension: Main idea identification, interpretation, critical analysis

Vocabulary Enhancement: One-word substitutes, Elocution- Speech delivery skills (organisation, voice modulation, fluency, pronunciation, and audience engagement)

Activity: Read and analyze passages for comprehension and critical interpretation, Read-Record-Reflect activity for improving reading fluency and pronunciation, Vocabulary exercises on one-

word substitutes, and deliver a short speech with emphasis on clarity, confidence, and effective expression

Activity- 4	2hrs
Think–Pair–Share Conversation (Podcast-Based), **Vocabulary Enhancement:** Introduction to authentic spoken English through podcasts, listening for gist and specific information, and note-taking Think–Pair–Share strategy, use of linking words and expressing agreement/disagreement politely **Vocabulary Enhancement**: Idioms in context and usage **Activity**: Listen to podcasts for comprehension and note-making, Think–Pair–Share discussions to exchange ideas and respond confidently, Speak-Record-Reflect activity for improving speaking fluency, pronunciation, and expression	

Activity-5	2 hrs
Group Discussion, Vocabulary Enhancement: GD format and roles, rules of participation, **Vocabulary –** Word Pairs, commonly confused words **Activity:** Engage in group discussions focusing on clear expression and interactionand word pair exercises	

Activity -6	2 hrs
Reading Comprehension, Visual Interpretation & Vocabulary Enhancement: Skimming and scanning, identifying main and supporting ideas, distinguishing fact and opinion **Visual Interpretation:** Interpreting visual cues, logical sequence **Vocabulary**: Phrasal Verbs: separable and inseparable forms, and contextual usage **Activity:** Engage in reading comprehension tasks for critical analysis, describe pictures ,Speak-Record–Reflect activity for improving fluency, pronunciation, and expression, and phrasal verbs practice exercises	

Activity-7	2 hrs
Motivational Speeches, Presentation Skills & Vocabulary Enhancement: identifying central theme and tone, note-taking, Narrative techniques **Presentation –** Speak to Inspire- topic selection, structure (introduction–body–conclusion), **Vocabulary Enhancement –** Collocations- Introduction to collocations, types of collocations, and contextual usage **Activity**: Listen to motivational speeches for comprehension and analysis, deliver a 3–5-minute inspirational presentation, Speak–Record–Replay activity for improving fluency, pronunciation, and expression, and collocations practice exercises	

Activity-8	2 hrs
Writing & Vocabulary Enhancement: Professional Resume Writing techniques, Action verbs in resume writing, Letterof Application, E-mail Etiquette—vocabulary: Jumbled sentences **Activity**: Prepare a professional resume using an appropriate format and action verbs, write a letter of application and formal e-mail following etiquette and jumbled sentence exercises	

Activity-9	2 hrs
Reading Comprehension, Newspaper Reading & Vocabulary Enhancement: Intensive reading , Extensive reading, Newspaper reading:5W1H method, Summarization, vocabulary building **Activity:** Reading comprehension exercises, Summarizing news content, discussion of current events, Speak–Record–Replay activity for improving fluency, pronunciation and expression Vocabulary building through contextual usage from news articles	

Activity-10	2 hrs

PowerPoint Presentations: Concept and purpose of presentations, layout and structure (title, introduction–body–conclusion), slide design elements, visual aids, common mistakes to avoid

Activity: Design and present a poster or PowerPoint presentation on a given topic, Speak–Record–Replay activity for improving fluency, pronunciation and expression, peer interaction and feedback sessions

Activity-11	**2hrs**

Essay Writing, Vocabulary Enhancement – Concept and Types of Essays**,** Essay structure (introduction–body–conclusion), paragraph coherence, clarity and objectivity, Sentence completion with correct word/Group alternative word/group

Activity: Write essays on given topics focusing on structure, coherence, and clarity Sentence completion practice exercises

Activity-12	**2hrs**

Mock Interview – Technical & HR: Introduction to mock interviews: Purpose and importance, types of interviews, interview etiquette, self-introduction, common HR questions, self-assessment

Activity: Mock interview with appropriate dress code Record and review own performance, Feedback session

Textbook(s):

1. Arun Sharma & Meenakshi Upadhyay, "*Verbal Ability and ReadingComprehension for CAT & Other Management Examinations*", 8th Edition, McGraw Hill Education (India) Private Ltd, Chennai, 2018
2. Meenashki Raman & Sangeethe Sharma, "*Technical Communication: Principles and Practice*, 3rdEdition, New Delhi, New York: Oxford University Press,2004

ReferenceBook(s):

1. Nishit KSinha, "Verbal Ability and Reading Comprehension for the CAT",3rdEdition Pearson India Education Services Pvt Ltd, Chennai
2. Harper Collins, "Collins COBUILD English Grammar" Third Edition, Harper Collins Publishers Ltd
3. Jerald J. Alfred, Charles T. Brusaw and Walter E Oliu," Handbook for Technical Writing"12thEdition, Macmillan
4. R.S.Agarwal, "Amodern Approach to Verbal and Non-Verbal Reasoning" Revised edition 2025, Chand Publishing, India

Web and Video link(s):

1. Learn/Practice English with MOVIES (Lesson#1) Title: The Incredibles : https://wwwyoutubecom/watch?v=5SfQhkMsUFk&list=PLA7lNLNvxTzig5dqfGl8DGbLOv_UI08yXg&index=2
2. Learn English with wreck-it ralph: https://wwwyoutubecom/watch?v=wVhG59zh4uQ&list=PLA7lNLNvxTzig5dqfGl8DGbLOvUI08yXg&index=4
3. The Pursuit of Happiness (2006): Most Powerful Moments!: https://wwwyoutubecom/watch?v=TkD1QvjKlqU
4. **Podcast by** RaulJohn "Inside the Mind of India's AI Kid" Business Today https://wwwyoutubecom/watch?v=biCrIlhZrC4
5. Podcast bySudhaMurthy-So What IfILosttheBattle,ILived theWar|TheRanveerShow https://wwwyoutubecom/watch?v=KwXtalUuhLc
6. Motivational Talk by Gour Gopal Das, SLEEPLESS Nights for Overnight SUCCESS https://wwwyoutubecom/watch?v=YyCXp_E4sMU

Motivational Talk by Admiral Mc Raven's Speech for Your Day, "5 Minutes to Start Your Day Right! - MORNING MOTIVATION" https://wwwyoutubecom/watch?v=b-Pn0yXL9y8

Course Articulation Matrix (CAM):		U24MH607 : TECHNICAL ENGLISH												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24MH607.1	-	-	-	-	-	-	-	-	2	-	2	1	1
CO2	U24MH607.2	-	-	-	-	-	-	-	2	2	-	2	1	1
CO3	U24MH607.3	-	-	-	-	-	-	-	-	2	-	2	1	1
CO4	U24MH607.4	-	-	-	-	-	-	-	2	2	-	2	1	1
U24MH607		-		-	-	-	-	-	1	2	-	2	1	1
3–HIGH,2 –MEDIUM,1-LOW														

CO	CO Statement – *The student should be able to*	Relevant SDG	SDG Description	Mapping Justification
CO1	Develop effective listening, speaking, reading, and writing skills by understanding native-speaker conversations and expressing ideas clearly and confidently using appropriate vocabulary, while maintaining fluency, coherence, and accurate pronunciation	SDG 4	Quality Education	As it develops effective communication and language proficiency skills that enhance learners' ability to communicate confidently and effectively, thereby promoting quality and inclusive education
CO2	Enhance communication and professional writing skills through podcast comprehension, group discussions, resume writing, and email writing	SDG 4	Quality Education	It strengthens professional communication and writing competencies required for lifelong learning and employability, contributing to quality education and skill development
CO3	Develop the ability to comprehend reading texts and conversations of both native and non-native speakers, interpret visual information, and produce clear and well-structured technical report	SDG 4, SDG 9	Quality Education, Industry, Innovation and Infrastructure	By improving comprehension and technical writing skills and with SDG-9 by enabling students to prepare structured technical reports that support innovation, research, and professional communication in engineering and industry
CO4	Develop the ability to perform effectively in interviews and deliver presentations with clarity of speech and appropriate pronunciation and accent	SDG 4, SDG 8	Quality Education, Decent Work and Economic Growth	This aligns with SDG-4 by enhancing communication and presentation skills and with SDG-8 by improving employability, interview performance, and professional competencies necessary for decent work and career growth

IOT FRAMEWORKS LABORATORY			
Class: B. Tech. VI – Semester		**Branch:** CSE (IoT)	
Course Code:	**U24IN608**	**Credits:**	**1**
Hours/Week (L-T-P- E):	**0-0-2-2**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1 : implement IoT systems for sensor data acquisition and communication using HTTP and MQTT protocols in real-time applications

CO2 : design and implement data processing, visualization, and automation workflows using Node-RED for smart IoT systems

CO3 : develop mobile applications using Flutter to monitor and control IoT systems through real-time data integration

CO4 : develop and integrate complete IoT solutions like smart home, greenhouse, weather, gas monitoring with real-time monitoring, control, and alert mechanisms

Experiment-1 (UNIT-I)

1. Implement a temperature-based room automation system that acquires sensor data and automatically controls devices like fan or air conditioner in real-time based on predefined thresholds

Experiment-2 (UNIT-I)

1. Develop a simple Node-RED flow to simulate and process IoT data streams
   i. Install and configure Node-RED
   ii. Create basic flows: inject, debug nodes

Experiment-3 (UNIT-I)

1. Develop and implement a Node-RED flow to process sensor data and implement real-time control logic for a smart home automation system

Experiment-4 (UNIT-II)

1. Environmental monitoring system:
   i. Develop a real-time IoT dashboard for monitoring environmental conditions using Node-RED
   ii. Implement an event-driven IoT system that stores and processes sensor data using Node-RED

Experiment-5 (UNIT-II)

1. Implement MQTT-based communication for real-time data exchange in an IoT-based alert system
   i. Setup MQTT broker (Mosquitto)
   ii. Implement publish–subscribe model
   iii. Exchange sensor data between device

Experiment-6 (UNIT-II)

1. Implement CoAP-based IoT communication using ESP32/Raspberry Pi and Node-RED for real-time sensor monitoring and protocol performance analysis

Experiment-7 (UNIT-III)

1. Demonstrate how environmental sensor data like soil moisture, temperature and humidity can be transmitted to a remote server using HTTP in a greenhouse automation system for monitoring and control

Experiment-8 (UNIT-III)

1. Develop a Flutter-based mobile application with basic UI components (widgets, layouts, and navigation) to display IoT system data

Experiment-9 (UNIT-III)
1. Develop a Flutter-based mobile application for Street Lights automation
Experiment-10 (UNIT-IV)
1. Develop a Flutter-based mobile application with basic UI components - widgets, layouts, and navigation to display and control data in a home automation system
Experiment-11 (UNIT-IV)
1. Implement a Flutter-based mobile application to visualize real-time weather parameters using IoT sensors
Experiment-12 (UNIT-IV)
1. Develop an IoT-based gas monitoring system with threshold-based alerts and real-time data visualization using a mobile application
Textbook(s): 1. Arshdeep Bahga, Vijay Madisetti, *Internet of Things: A Hands-On Approach*, Universities Press, 1st edition, 2015, India (Chapters 1 to 10) 2. Rajkamal, *Internet of Things: Architecture, Protocols and Applications*, McGraw Hill Education, 2nd edition, 2017, India (Chapters 2 to 8, 10 to 12)
Reference Book(s): 1. Rolando Herrero, *Practical Internet of Things Networking*, Springer, 1st edition, 2023, Switzerland (Chapters 3 to 9) 2. Cuno Pfister, *Getting Started with the Internet of Things*, O'Reilly Media, 1st edition, 2011, USA (Chapters 4 to 8) 3. Peter Waher, *Learning Internet of Things*, Packt Publishing, 1st edition, 2015, UK (Chapters 5 to 10) 4. Samuel Greengard, *The Internet of Things*, MIT Press, 1st edition, 2015, USA (Chapters 6 to 10)
Web and Video link(s): https://youtubecom/playlist?list=PLTLcz6IpeLYJIjfJ8n_MArB3BbnQAji_m&si=vyfplCWrQpDGpjeN, Rajiv Singh, Basics of Node-Red
Laboratory Manual (for laboratory component): *Industrial IoT Frameworks Enthus Technologies Laboratory Manual,* Department of CSE (Networks), KITSW

Course Articulation Matrix (CAM):		U24IN608 : IOT FRAMEWORKS LABORATORY												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24IN608.1	2	2	2	2	3	2	1	1	1	1	-	3	3
CO2	U24IN608.2	2	2	2	2	3	2	1	1	1	1	-	3	3
CO3	U24IN608.3	2	2	2	2	3	2	1	1	1	1	-	3	3
CO4	U24IN608.4	2	2	2	3	3	3	1	1	1	1	-	3	3
U24IN608		2	2	2	2.25	3	2.25	1	1	1	1	-	3	3
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement (The student should be able to…)**	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	implement iot systems for sensor data acquisition and communication using http, mqtt, and coap protocols in real-time applications	**SDG 9**	Industry, Innovation and Infrastructure	Lightweight IoT communication protocols such as HTTP, MQTT, and CoAP enable efficient industrial automation, smart sensing, and reliable connected infrastructure systems
CO2	design and implement data processing, visualization, and automation workflows using node-red for smart iot systems	**SDG 9**	Industry, Innovation and Infrastructure	IoT workflows and automation improve efficiency, enable intelligent decision-making, and support development of innovative industrial and smart infrastructure systems
CO3	develop mobile applications using flutter to monitor and control iot systems through real-time data integration	**SDG 11**	Sustainable Cities and Communities	Mobile-enabled IoT systems support smart city applications such as home automation, environmental monitoring, and urban management, enhancing quality of life
CO4	develop and integrate complete iot solutions like smart home, greenhouse, weather, and gas monitoring with real-time monitoring, control, and alert mechanisms	**SDG 11, SDG 13**	Sustainable Cities and Communities, Climate Action	IoT applications like greenhouse and weather monitoring contribute to sustainable resource management and climate awareness, while smart home systems enhance urban sustainability and safety

INDUSTRIAL IOT LABORATORY			
Class: B Tech VI – Semester		**Branch:** CSE (IoT)	
Course Code:	**U24IN609**	**Credits:**	**1**
Hours/Week (L-T-P- E):	**0-0-2-2**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1 : understand Industrial IoT laboratory tools, CISCO Packet Tracer simulation environment, and sensor interfacing techniques for basic IoT applications

CO2 : design and develop IoT-based smart automation systems for home, environmental, and industrial monitoring applications using sensors, cloud platforms, and embedded controllers

CO3 : apply industrial communication protocols, ARM Cortex controllers, RFID, LoRaWAN, CAN protocol, and intelligent analytics in Industrial IoT applications

CO4 : design and implement real-time Industrial IoT solutions for smart traffic, environmental monitoring, soil analysis, smart farming, and greenhouse management applications

Experiment-1 (UNIT-I)

1. Introduction to Industrial IoT Laboratory
2. Demonstration of CISCO packet Tracer

Experiment-2 (UNIT-I)

1. Interfacing of ultrasonic sensor and display distance value in OLED display ETS kit

Experiment-3 (UNIT-I)

Smart Irrigation system:

1. Interfacing and turn on & off the relay on ETS kit
2. Automate the motor based on the soil moisture values

Experiment-4 (UNIT-II)

1. Design and develop a smart home automation system using CISCO
2. Design and develop a Smart home automation using ETS kit

Experiment-5 (UNIT-II)

1. Design and develop to monitor the temperature & humidity of the environment using SHT31 sensor, uploading the data to the cloud
2. Design and develop weather forecasting using CISCO Packet Tracer

Experiment-6 (UNIT-II)

1. Develop and implement a Vehicle-to-Vehicle (V2V) communication system using the CAN (Controller Area Network) protocol with ARM Cortex/ ETS/ ESP32/ Raspberry Pi microcontrollers

Experiment-7 (UNIT-III)

1. Design and develop disease prediction and analysis system for smart farming

Experiment-8 (UNIT-III)

Inventory management system:

1. Interfacing the RFID sensor using ARM Cortex/ ETS/ ESP32/ Raspberry Pi microcontrollers
2. Monitor RFID data in LoraWAN to the cloud

Experiment-9 (UNIT-III)

1. Design and implement a Smart Traffic Management System to monitor and control traffic flow at road intersections using ARM Cortex/ ETS/ ESP32/ Raspberry Pi microcontrollers

Experiment-10 (UNIT-IV)

1. Design and implement an IoT-based Wind Monitoring System to measure and monitor environmental parameters related to wind conditions using ARM Cortex/ ETS/ ESP32/ Raspberry Pi microcontrollers

Experiment-11 (UNIT-IV)

1. Design and implement an IoT-based Smart Soil Monitoring System to measure and analyze soil pH and Electrical Conductivity (EC) in real time Interface Soil pH and Soil EC sensors with the controller to monitor soil health parameters, transmit the collected data to a cloud using ARM Cortex/ ETS/ ESP32/ Raspberry Pi microcontrollers

Experiment-12 (UNIT-IV)

1. A Case study is assigned as Project to student on Greenhouse

Textbook(s):

1. Arshdeep Bahga, Vijay Madisetti, *Internet of Things: A Hands-On Approach*, Universities Press, 1st edition, 2015, India (Chapters 1 to 10)
2. Rajkamal, *Internet of Things: Architecture, Protocols and Applications*, McGraw Hill Education, 2nd edition, 2017, India (Chapters 2 to 8, 10 to 12)

Reference Book(S):

1. Rolando Herrero, *Practical Internet of Things Networking*, Springer, 1st edition, 2023, Switzerland (Chapters 3 to 9)
2. Cuno Pfister, *Getting Started with the Internet of Things*, O'Reilly Media, 1st edition, 2011, USA (Chapters 4 to 8)
3. Peter Waher, *Learning Internet of Things*, Packt Publishing, 1st edition, 2015, UK (Chapters 5 to 10)
4. Samuel Greengard, *The Internet of Things*, MIT Press, 1st edition, 2015, USA (Chapters 6 to 10)

Web and Video link(s):

https://youtubecom/playlist?list=PLTLcz6IpeLYJIjfJ8n_MArB3BbnQAji_m&si=vyfplCWrQpDGpjeN, by Rajiv Singh, Basics of Node-Red

Laboratory Manual (for laboratory component):

Industrial IoT Enthus Technologies Laboratory Manual, Department of CSE (Networks), KITSW

Course Articulation Matrix (CAM):		U24IN609 : INDUSTRIAL IOT LABORATORY												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24IN609.1	2	2	2	2	1	2	1	1	1	1	-	3	2
CO2	U24IN609.2	2	2	2	2	3	2	1	1	1	1	-	3	3
CO3	U24IN609.3	2	2	2	2	3	2	1	1	1	1	-	3	3
CO4	U24IN609.4	2	2	2	3	3	3	1	1	1	1	-	3	3
U24IN609		2	2	2	2.25	3	2.25	1	1	1	1	-	3	2.75
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	understand industrial iot laboratory tools, cisco packet tracer simulation environment, and sensor interfacing techniques for basic iot applications	**SDG 9**	Industry, Innovation and Infrastructure	Hands-on experience with Industrial IoT tools, simulations, and sensor interfacing develops the technical skills required to build innovative, reliable, and sustainable industrial systems.
CO2	design and develop iot-based smart automation systems for home, environmental, and industrial monitoring applications using sensors, cloud platforms, and embedded controllers	**SDG 11**	Sustainable Cities and Communities	IoT-enabled automation and monitoring systems improve resource management, environmental sustainability, energy efficiency, and public safety, supporting smart and sustainable communities.
CO3	apply industrial communication protocols, arm cortex controllers, rfid, lorawan, can protocol, and intelligent analytics in industrial iot applications	**SDG 9**	Industry, Innovation and Infrastructure	Industrial communication technologies and intelligent analytics enhance automation, interoperability, and efficiency, driving innovation in modern industrial infrastructure.
CO4	design and implement real-time industrial iot solutions for smart traffic, environmental monitoring, soil analysis, smart farming, and greenhouse management applications	**SDG 2, SDG 11, SDG 13**	Zero Hunger; Sustainable Cities and Communities; Climate Action	Real-time Industrial IoT solutions support precision agriculture, environmental conservation, smart urban infrastructure, and climate-resilient systems, contributing to sustainable development across agriculture, cities, and environmental protection.

DEVOPS LABORATORY			
Class: B. Tech. VI – Semester		**Branch:** CSN (IoT)	
Course Code:	**U24IN610**	**Credits:**	**1**
Hours/Week (L-T-P- E):	**0-0-2-2**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1 : Implement version control and remote repository management using Git and GitHub

CO2 : develop build automation scripts and manage dependencies using maven and build tools

CO3 : implement containerization and deployment using Docker and Kubernetes

CO4 : design and implement CI/CD pipelines integrating Nodejs applications using Jenkins

Experiment-1 (Unit-I)

1. Install and configure Git on the system and perform basic Git operations such as init, add, commit, log, and tracking file changes

Experiment-2 (Unit-I)

1. Create branches and perform branch management operations such as branch creation, switching, merging, and deletion using Git

Experiment-3 (Unit-I)

1. Connect the local Git repository with a remote repository on GitHub and perform remote operations such as push, pull, and clone

Experiment-4 (Unit-II)

1. Perform basic Linux commands for file and directory management, navigation, and viewing system information
2. Manage files, directories, permissions, and processes using intermediate Linux administration commands in Linux

Experiment-5 (Unit-II)

1. Create and execute shell scripts using Bash scripting concepts such as variables, conditional statements, loops, and functions in Bash
2. Configure and manage cron jobs for task scheduling and automation in Linux using the crontab utility

Experiment-6 (Unit-II)

1. Create, manage, and build Java applications using Project Object Model (POM), Maven coordinates, dependencies, plugins, and project execution features in Apache Maven
2. Install and configure npm and understand package management concepts in Nodejs

Experiment-7 (Unit-III)

1. Install and configure Docker and work with Docker images by pulling, creating, tagging, and pushing images to Docker Hub

Experiment-8 (Unit-III)

1. Create and build custom Docker images using Dockerfile instructions and container configuration in Docker
2. Create and build custom Docker images using Dockerfile instructions and container configuration in Docker

Experiment-9 (Unit-III)

1. Configure and manage multi-container applications using Docker Compose, networking, and troubleshooting commands in Docker Compose
2. Install and configure a Kubernetes cluster and create basic Pod configurations using

YAML files

Experiment-10 (Unit-IV)

1. Install and configure Jenkins on Linux and explore the Jenkins dashboard, system configuration, and plugin management features
2. Integrate GitHub and Docker with Jenkins to automate source code retrieval, image building, and deployment processes

Experiment-11 (Unit-IV)

1. Create and execute Freestyle projects in Jenkins for automated build and testing processes

Experiment-12 (Unit-IV)

1. Develop and execute CI/CD pipelines using Jenkinsfile and Pipeline as Code concepts in Jenkins
2. Configure build triggers such as Poll SCM and Webhooks for automated project execution in Jenkins

Textbook(s):

1. Mikael Krief, Learning DevOps, Second Edition,2022(chapter 1,7,10)
2. William Shotts, The Linux Command Line, A Complete introduction, 2nd edition 2019(chapter 1 to 10)
3. Scott Chacon, Ben Straub, everything you need to know about git, Pro Git,2025 Dec 12(chapter1 to3)
4. Bobby Iliev, Introduction to Docker, 2024 August 19(chapter 1 to 8)

Reference Book(S):

1. Iriarte Koroliova EW *MERN Quick Start Guide: Build Web Applications with MongoDB, Expressjs, React, and Node* Packt Publishing, 2018 ISBN: 978-1787281080
2. Ravindran A *Django Design Patterns and Best Practices* 2nd ed Packt Publishing, 2018 ISBN: 978-1788831345

Web and Video link(s):

1. https://wwwyoutubecom/playlist?list=PL9ooVrP1hQOE5ZDJJsnEXZ2upwK7aTYiX
2. https://wwwyoutubecom/watch?v=Ou9j73aWgyE

Laboratory Manual (for laboratory component):

1. Computer Networks Manual and Record Book, Department of CSE (Networks), KITSW

Course Articulation Matrix (CAM):		U24IN610 : DEVOPS LABORATORY												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24IN610.1	2	2	2	1	3	2	1	1	1	-	2	2	2
CO2	U24IN610.2	3	2	2	2	3	2	1	1	1	-	2	2	2
CO3	U24IN610.3	3	2	2	2	3	2	1	2	2	-	2	2	2
CO4	U24IN610.4	3	3	2	2	3	2	1	2	2	-	2	2	2
U24IN610		2.75	2.25	2	1.75	3	2	1	1.5	1.5	-	2	2	2
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	implement version control and remote repository management using git and github	SDG4	Quality Education	The course introduces version control and collaborative development practices using Git and GitHub, equipping students with industry-relevant skills and promoting continuous learning aligned with modern software development workflows
CO2	develop build automation scripts and manage dependencies using maven and build tools	SDG9	Industry, Innovation and Infrastructure	Nodejs automation and dependency management enable efficient software development workflows, supporting scalable and innovative digital infrastructure
CO3	implement containerization and deployment using docker and kubernetes	SDG9	Industry, Innovation and Infrastructure	Containerization and orchestration technologies support scalable, reliable, and efficient deployment of applications in modern cloud infrastructure
CO4	design and implement ci/cd pipelines integrating nodejs applications using jenkins	SDG8	Decent Work and Economic Growth	CI/CD automation improves productivity, reduces manual effort, and enhances software delivery efficiency, contributing to modern digital workforce practices

MINI PROJECT			
Class: B. Tech. VI – Semester		**Branch:** CSE(IoT)	
Course Code:	U24IN611	**Credits:**	**1**
Hours/Week (L-T-P- E):	**0-0-2-1**	**CIE:**	**60%**
Total Number of Teaching Hours:	**-**	**ESE:**	**40%**

Course Learning Outcomes (COs):

After completion of this course, the students should be able to,

CO1: apply knowledge to practice to design & conduct experiments and utilize modern tools for developing working models/process/system leading to innovation & entrepreneurship

CO2: demonstrate the competencies to perform literature survey, identify gaps, analyze the problem and prepare a well-documented Mini project report

CO3: make an effective oral presentation through informative PPTs, showing knowledge on the subject & sensitivity towards social impact of the Mini project

CO4: write a "Mini project paper" in scientific journal style & format from the prepared Mini project report and create a video pitch on Mini project

Student has to take up independent mini project on innovative ideas, innovative solutions to common problems using their knowledge relevant to courses offered in their program of study, which would supplement and complement the program assigned to each student

Guidelines:

1. The HoD shall constitute a *Department Mini Project Evaluation Committee (DMPEC)*
2. *DMPEC* shall allot a faculty supervisor to each student for guiding on (i) selection of topic (ii) literature survey and work to be carried out (iii) preparing a report in proper format and (iv) effective mini project oral presentation
3. There shall be only continuous Internal Evaluation (CIE) for miniproject

The CIE for mini project is as follows:

Assessment	Weightage
Mini Project Supervisor Assessment	15%
Working model / process / software package / system developed	20%
Mini Project report	15%
Mini Project paper	10%
Video pitch	10%
DMPEC Assessment: *Oral presentation with PPT and viva-voce*	15%
SDG Alignment	5%
Research Alignment	10%
Total Weightage:	**100%**

Note: It is mandatory for the student to appear for oral presentation and viva-voce to qualify for course evaluation

(a) **Mini Project Topic**: The topic should be interesting and conducive to discussion Topics may be found by looking through recent issues of peer reviewed Journals / Technical Magazines on the

topics of potential interest

(b) **Working Model**: Each student is requested to develop a working model / process / system on the chosen work and demonstrate before the *DMPEC* as per the dates specified by *DMPEC*

(c) **Report:** Each student is required to submit a well-documented report on the chosen seminar topic as per the format specified by *DMPEC*

(d) **Anti-Plagiarism Check:** The seminar report should clear plagiarism check as per the Anti-Plagiarism policy of the institute

(e) **Presentation:** Each student should prepare PPT with informative slides and make an effective oral presentation before the *DMPEC* as per the schedule notified by the department

(f) **Video Pitch:** Each student should create a pitch video, which is a video presentation on his / her mini project Video pitch should be no longer than 5 minutes by keeping the pitch concise and to the point, which shall also include key points about his / her business idea / plan (*if any*) and social impact

(g) The student has to register for the Mini project as supplementary examination in the following cases:

i) he/she is absent for oral presentation and viva-voce

ii) he/she fails to submit the report in prescribed format

iii) he/she fails to fulfill the requirements of Mini project evaluation as per specified guidelines

iv) The CoE shall send a list of students registered for supplementary to the HoDconcerned

v) The DSEC, duly constituted by the HoD, shall conduct Mini project evaluation and send the award list to the CoE within the stipulated time

Course Articulation Matrix (CAM):		**U24IN611 MINI PROJECT**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	U24IN611.1	3	3	2	3	3	2	1	2	1	2	2	2	2
CO2	U24IN611.2	2	2	2	3	2	1	1	1	2	1	3	2	2
CO3	U24IN611.3	1	1	1	1	2	2	1	2	3	1	2	2	2
CO4	U24IN611.4	1	2	1	2	2	1	2	1	3	1	2	2	2
U24IN611		1.75	**2**	**1.5**	**2.25**	**2.25**	**1.5**	**1.25**	**1.5**	**2.25**	**1.25**	**2.25**	2	2
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	apply knowledge to practice to design & conduct experiments and utilize modern tools for developing working models / process / system leading to innovation & entrepreneurship	**SDG 9**	Industry, Innovation and Infrastructure	Mini projects involve the design and development of innovative ECE solutions such as IoT systems, embedded systems, communication networks, VLSI applications, and intelligent electronic devices These activities promote technological innovation, entrepreneurship, and sustainable industrial infrastructure
CO2	demonstrate the competencies to perform literature survey, identify gaps, analyze the problem and prepare a well-documented Mini project report	**SDG 4**	Quality Education	Literature review, problem analysis, technical documentation, and independent learning enhance research skills, critical thinking, and lifelong learning capabilities, thereby supporting quality technical education and knowledge creation
CO3	make an effective oral presentation through informative PPTs, showing knowledge on the subject & sensitivity towards social impact of the Mini project	**SDG 11**	Sustainable Cities and Communities	Presentation and discussion of ECE-based solutions for smart cities, intelligent transportation systems, environmental monitoring, public safety, healthcare technologies, and digital connectivity contribute to sustainable and inclusive community development
CO4	write a "Mini project paper" in scientific journal style & format from the prepared Mini project report and create a video pitch on Mini project	**SDG 12**	Responsible Consumption and Production	Scientific reporting and dissemination of project outcomes promote responsible innovation, ethical publication practices, efficient utilization of resources, and sustainable technology development

QISKIT PROGRAMMING			
Class: B.Tech. Syllabi of exit course for UG certificate in CSE(IOT)		**Branch:** CSE(IOT)	
Course Code:	**U24IN612X**	**Credits:**	**3**
Hours/Week (L-T-P-E):	**2-0-2-4**	**CIE Marks (%):**	**60**
Total Number of Teaching Hours:	**32 Hrs**	**ESE Marks (%):**	**40**

Course Learning Outcomes (COs):

This course will develop students' knowledge in /on…

CO1: understand quantum computing fundamentals, qubits, superposition, measurement, and the Bloch sphere

CO2: develop quantum programs using Python and Qiskit to construct, simulate, and visualize quantum circuits

CO3: implement quantum gates, multi-qubit circuits, entanglement, and quantum communication protocols.

CO4: design and analyze quantum algorithms including Deutsch, Deutsch–Jozsa, Grover's Search, and introductory Shor's algorithm

CO5: execute quantum programs on IBM Quantum simulators and cloud quantum hardware

CO6: develop application-oriented quantum solutions using the Qiskit programming framework

CO7: develop applications using multi-qubit quantum circuits, Bell-state generation, and entanglement-based algorithms

CO8: : analyze and implement Quantum Key Distribution (BB84) and other secure quantum communication protocols

THEORY COMPONENT

UNIT-I	**4 Hrs**

Foundations of Quantum Computing: Classical vs. quantum computing, bits and qubits,quantum states, superposition, complex numbers, Bloch sphere, quantum measurement, and fundamentals of quantum information.

UNIT-II	**4 Hrs**

Qiskit Programming Fundamentals: Introduction to Python for quantum programming, Qiskit installation and development environment, quantum circuit construction and visualization, quantum simulators, implementation of single-qubit gates (X, Y, Z, H, S, T), and quantum measurement.

UNIT-III	**4 Hrs**

Multi-Qubit Systems and Quantum Information: Tensor products, multi-qubit systems, controlled quantum gates (CNOT and Toffoli), Bell states, quantum entanglement, quantum teleportation, superdense coding, and BB84 quantum key distribution protocol.

UNIT-IV	**4 Hrs**

Quantum Algorithms and Applications: Deutsch, Deutsch–Jozsa, Grover's search, introductory Shor's algorithm, quantum noise models, quantum error correction, IBM Quantum Runtime, and applications in cryptography, optimization, artificial intelligence, and scientific computing.

LABORATORY COMPONENT

List of Experiments

1. Experiment 1: Qiskit installation and IBM Quantum account setup.
2. Experiment 2: First quantum circuit and simulator execution.
3. Experiment 3: Single-qubit gates and Bloch sphere visualization.
4. Experiment 4: Quantum measurement and probability analysis.
5. Experiment 5: Multi-qubit circuits and Bell-state generation.

6. Experiment 6: Entanglement verification using Qiskit.
7. Experiment 7: Quantum teleportation implementation.
8. Experiment 8:Superdense coding implementation and BB84 quantum key distribution simulation.

Textbook(s):

1. Thomas G. Wong, Introduction to Classical and Quantum Computing, Rooted Grove Publications, 2022.Reference Chapters: Chapters 1, 3, 5–8 (Approx. Pages 1–220)
2. Jack D. Hidary, Quantum Computing: An Applied Approach, 2nd Edition, Springer Nature, 2021.Reference Chapters: Chapters 2–6 (Approx. Pages 27–235)
3. Robert Loredo, Quantum Computing with Qiskit, Packt Publishing Ltd., 2024.Reference Chapters: Chapters 1–9 (Approx. Pages 1–280)

Reference Book(s):

1. Michael A. Nielsen and Isaac L. Chuang, *Quantum Computation and Quantum Information*, Cambridge University Press, 10th Anniversary Edition, 2010.
2. Eleanor Rieffel and Wolfgang Polak, *Quantum Computing: A Gentle Introduction*, MIT Press, 2011.
3. Eric R. Johnston, Nic Harrigan and Mercedes Gimeno-Segovia, *Programming QuantumComputers*, O'Reilly Media, 2019.
4. Chris Bernhardt, *Quantum Computing for Everyone*, MIT Press, 2019.
5. M. Schuld and F. Petruccione, *Machine Learning with Quantum Computers*, Springer, 2021.

Web and Video link(s):

https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_cs89, *NPTELVideo Lecture on Introduction to Quantum Computing: Quantum Algorithms and Qiskit byProf. Prabha Mandayam, Prof. Anupama Ray, Prof. Sheshashayee Raghunathan IIT Madras.*

Laboratory Manual (for laboratory component):

2. *Qiskit Programming Manual,* Department of CSE(N), KITSW

Course Articulation Matrix (CAM):		**U24IN612X: QISKIT PROGRAMMING**												
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	**U24IN612X.1**	3	2	1	1	1	-	1	-	1	-	-	2	2
CO2	**U24IN612X.2**	3	3	2	2	3	-	1	-	1	-	2	2	2
CO3	**U24IN612X.3**	3	3	3	3	3	-	1	-	1	-	2	2	3
CO4	**U24IN612X.4**	3	3	3	3	3	-	1	-	1	-	2	2	3
CO5	**U24IN612X.5**	3	3	2	2	3	-	1	1	1	-	2	2	3
CO6	**U24IN612X.6**	3	3	3	3	3	-	1	1	1	-	2	2	3
CO7	**U24IN612X.7**	3	3	3	3	3	-	1	1	1	-	2	3	3
CO8	**U24IN612X.8**	3	3	2	3	3	1	1	1	1	-	3	3	3
U24IN612X		**3.00**	**2.88**	**2.38**	**2.50**	**2.75**	**0.13**	**1.00**	**0.50**	**1.0**	**-**	**1.88**	**2.25**	**2.75**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	explain quantum computing concepts and qubit operations	SDG 4	Quality Education	Introduces advanced concepts in quantum information science and modern computing
CO2	develop qiskit programs using quantum gates and circuits	SDG 9	Industry, Innovation and Infrastructure	Promotes next-generation computing technologies and innovation
CO3	analyze entanglement and quantum communication protocols	SDG 9	Industry, Innovation and Infrastructure	Supports future secure communication and quantum networking technologies
CO4	implement and evaluate quantum algorithms	SDG 9	Industry, Innovation and Infrastructure	Enables computational innovation for optimization and AI
CO5	execute quantum programs on ibm quantum platforms	SDG 4	Quality Education	Provides experiential learning using industrial quantum computing platforms
CO6	develop application-oriented quantum solutions using qiskit	SDG 9	Industry, Innovation and Infrastructure	Encourages practical development of quantum software applications
CO7	develop applications using multi-qubit circuits and bell-state algorithms	SDG 9	Industry, Innovation and Infrastructure	Supports development of scalable quantum computing and networking solutions
CO8	analyze quantum key distribution simulations	SDG 16	Peace, Justice and Strong Institutions	Quantum cryptography enhances secure communication, digital trust, and cybersecurity infrastructure

IOT SECURITY			
Class: B.Tech. Syllabi of exit course for UG certificate in CSE(IOT)		**Branch:** CSE (IoT)	
Course Code:	**U24IN613X**	**Credits:**	**3**
Hours/Week (L-T-P- E):	**2-0-2-4**	**CIE:**	**60%**
Total Number of Teaching Hours:	**32 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (Cos)

After completion of this course, the students should be able to,

CO1 : explain IoT security architecture, privacy issues, threats, vulnerabilities, and defense mechanisms across different layers of IoT systems

CO2 : analyze malware propagation models, IoT security architectures, and network resilience techniques to develop effective security strategies for IoT environments

CO3 : apply cryptographic techniques, authentication mechanisms, and key management schemes for securing constrained IoT devices and communication system

CO4 : evaluate secure communication protocols, privacy-preserving techniques, advanced IoT security solutions

CO5: configure Contiki-NG OS and simulate IoT devices, wireless sensor networks, and RPL-based IoT topologies

CO6: design and implement IoT communication networks using RPL, 6LoWPAN, MQTT/MQTT-SN, HTTP, and IoT cloud platforms

CO7: develop IoT applications for real-time data acquisition, visualization, and cloud integration using Contiki-NG, Cooja, and Kodular

CO8: analyze IoT network performance and security using simulation tools and packet analysis for secure and reliable IoT communication

UNIT-I	4 Hrs

Threats in IoT: Introduction to IoT security and privacy, Phases of IoT system, Attacks as per IoT rchitecture,

IoT Threats and Defense: Common IoT attacks (Device, Network, and Application Layer), Malware and botnets, Basic defense mechanisms, Network robustness and resilience.

UNIT-II	4 Hrs

Malware Propagation and Control in IoT: Introduction to malware in IoT, Malware chemes in IoT, Modeling malware dynamics , Optimal control of malware

Architecture Model for IoT Security and Privacy: Limitations of current technologies and emerging solutions for IoT, Introducing NG as an IoT architecture

UNIT-III	4 Hrs

Cryptography and Authentication for IoT: Introduction to cryptography for IoT, Security requirements in constrained IoT devices, Symmetric key cryptography, Asymmetric key cryptography, Elliptic curve cryptography (ECC), Hash functions, Message authentication codes (MAC), Digital signatures

UNIT-IV	4 Hrs

Secure Communication Protocols for IoT: Transport layer security (TLS) , Datagram TLS (DTLS), Secure IoT communication protocols

Privacy Preservation and Advanced Security in IoT: Privacy-preserving Techniques in iot, Time series data aggregation schemes, Data anonymization techniques, Differential privacy, Trust management in IoT

Laboratory Component

List of Experiments

1. Introduction to Contiki OS - An operating system and framework forIoT-Installation, demonstration of virtual box
2. Introduction to Contiki OS command.
3. Design a wireless sensor network that generates the data, transmits the data through internet and stores into IoT Cloud. Implementation of virtual sensos in Contiki NG OS. Implemention of three sensors namely temperature, humidity, pressure sensor in Contiki NG OS.
4. Design an IoT Network that consists of three RPL Border Router. Each RPL Border Router has two different edge network and each RPL border router is used to connect a regular IP network with a RPL 6LoWPAN edge network. To perform this activity, create a network topology of 50 nodes and establish the connection between them. Display the data and visualize the data using MicaZ, Sky, Trxeb1120 and Trxeb2520 motes.
5. Create a moile app using kodular that displays real-time weather datafrom an ioT device over Wifi using HTTP or MQTT protocol.
6. Design an MQTT-SN that exchanges the messages between the node and the broker of the network. Create a simulation with RPL border router device to coect a regulr IP network topology of 50 nodes and establish the conection between them. Display the dta and visualize the data . (Hint: Contiki OS, Cooja Emulator, and Wireshark) using Z1 motes.
7. Dsign a wireless sensor network that generates the data, transmit the data through internet and stores into IoT cloud. To perform this activity create a network topology of 10 nodes and establish the conection between them. Display the data and visualize the data. (Hint: Contiki OS, Cooja Emulator, and Ubidots)
8. Design an IoT network that consists of three RPL Border routers has 2 different edge network and each RPL order router is used to connect a regular IP network with RPL 6LoWPaN edge network. To perform this activity ceate network topology of 50 Nodes and estlish the conction between them. Diply the data an visualize the data using Z1 mote.

Textbook(s):

1. Fei Hu, *Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations*, 1st Edition, CRC Press, New York, 2016 (Chapters 1–4, 6, 11–12, 14, 15, 17)
2. William Stallings, *Cryptography and Network Security,* 7th Edition, Pearson Education, United Kingdom (Chapters: 1-19, 22-23)

Reference Book(s):

1. Syed Rameem Zahra and Mohammad Ahsan Chishti, *Security and Privacy in the Internet of Things*, 1st Edition, CRC Press, New York, 2021
2. Vijay Madisetti and Arshdeep Bahga, *Internet of Things (A Hands-on Approach)*, 1st Edition, Orient Blackswan Private Limited, New Delhi, 2015
3. Md Husamuddin and Mohammed Qayyum, *Internet of Things: A Study on Security and Privacy Threats*, Proceedings of the 2017 2nd International Conference on Anti-Cyber Crimes (ICACC), 2017
4. Muhammad Aqeel, Fahad Ali, Muhammad Waseem Iqbal, Toqir A Rana, Muhammad Arif and Md Rabiul Auwul, *A Review of Security and Privacy Concerns in the Internet of Things (IoT)*, Hindawi Journal of Sensors, Volume 2022

Web and Video link(s):

https://onlinecoursesnptelacin/noc22_ee116/preview,*NPTEL Video Lecture on Cryptography and Networks Security by Prof Sourav Mukhopadhyay, Professor of CSE, IIT Kharagpur*

Laboratory Manual (for laboratory component):

IoT Testing Tools L*aboratory manual,* Department of CSE(N), KITSW

Course Articulation Matrix (CAM):		U24IN613X: IOT SECURITY												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24IN613X.1	1	2	2	1	1	-	1	-	1	-	2	2	2
CO2	U24IN613X.2	2	2	2	2	1	-	1	-	1	-	2	2	2
CO3	U24IN613X.3	2	2	3	2	1	-	1	-	1	-	2	3	3
CO4	U24IN613X.4	2	2	3	3	1	-	1	-	1	-	2	3	3
CO5	U24IN613X.5	2	2	3	2	3	-	1	-	2	1	2	3	3
CO6	U24IN613X.6	2	2	3	2	3	-	1	-	2	1	2	3	3
CO7	U24IN613X.7	2	2	3	2	3	-	1	-	2	1	2	3	3
CO8	U24IN613X.8	2	3	3	3	3	-	1	-	2	1	2	3	3
U24IN613X		1.75	2	2.50	2	1	-	1	-	1	-	2	2.50	2.50
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	explain iot security architecture, privacy issues, threats, vulnerabilities, and defense mechanisms across different layers of iot systems.	**SDG 9**	Industry, Innovation and Infrastructure	Understanding IoT security architecture and defense mechanisms supports the development of secure and resilient digital infrastructure
CO2	analyze malware propagation models, iot security architectures, and network resilience techniques to develop effective security strategies for iot environments.	**SDG 9**	Industry, Innovation and Infrastructure	Malware analysis and resilient network design enhance the reliability and sustainability of IoT infrastructure
CO3	apply cryptographic techniques, authentication mechanisms, and key management schemes for securing constrained iot devices and communication systems.	**SDG 16**	Peace, Justice and Strong Institutions	Cryptography and authentication strengthen cybersecurity, data protection, and secure digital communication
CO4	evaluate secure communication protocols, privacy-preserving techniques, and advanced iot security solutions.	**SDG 9, SDG 16**	Industry, Innovation and Infrastructure; Peace, Justice and Strong Institutions	Secure communication and privacy-preserving techniques promote resilient IoT systems and trustworthy digital ecosystems
CO5	configure contiki-ng os and simulate iot devices, wireless sensor networks, and rpl-based iot topologies.	**SDG 9**	Industry, Innovation and Infrastructure	Simulation of IoT networks and wireless sensor systems supports innovation in secure communication infrastructure
CO6	design and implement iot communication networks using rpl, 6lowpan, mqtt/mqtt-sn, http, and iot cloud platforms.	**SDG 9, SDG 11**	Industry, Innovation and Infrastructure; Sustainable Cities and Communities	Secure IoT communication and cloud-enabled networks facilitate smart infrastructure and sustainable urban services
CO7	develop iot applications for real-time data acquisition, visualization, and cloud integration using contiki-ng, cooja, and kodular.	**SDG 11**	Sustainable Cities and Communities	IoT-based real-time monitoring and visualization support smart city applications and sustainable community development
CO8	analyze iot network performance and security using simulation tools and packet analysis for secure and reliable iot communication.	**SDG 9, SDG 16**	Industry, Innovation and Infrastructure; Peace, Justice and Strong Institutions	Performance evaluation and security analysis improve resilient IoT infrastructure and trustworthy communication systems.

PROMPT ENGINEERING			
Class: B.Tech. Syllabi of exit course for UG certificate in CSE(IOT)		**Branch:** CSE (IOT)	
Course Code:	**U24IN614X**	**Credits:**	**3**
Hours/Week (L-T-P- E):	**2-0-2-4**	**CIE:**	**60%**
Total Number of Teaching Hours:	**32 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1 : understand the fundamentals of Generative AI, including generative models, deep learning architectures, and their applications in text, image, audio, and video generation

CO2 : analyze the architecture and working principles of autoregressive models, Transformers, GANs, GPT, and BERT for generating intelligent and context-aware outputs

CO3 : apply Variational Autoencoders (VAEs), Diffusion Models, and Flow-based Models to develop generative AI solutions for real-world applications

CO4 : design effective prompts using zero-shot, few-shot, chain-of-thought, and prompt tuning techniques to improve the performance and reliability of Generative AI systems while considering ethical and bias-related issues

CO5: apply prompt engineering techniques, including zero-shot, few-shot, multi-shot, and Chain-of-Thought (CoT) prompting, to generate accurate and context-aware responses using Large Language Models (LLMs)

CO6: develop Generative AI applications using pre-trained transformer models, Retrieval-Augmented Generation (RAG), and APIs for text and image generation

CO7: utilize Generative AI tools and frameworks to perform text generation, summarization, translation, question answering, sentiment analysis, and image generation for real-world applications

CO8: evaluate the performance, reliability, and ethical implications of Generative AI systems by analyzing hallucinations, bias, unsafe outputs, and responsible AI practices

UNIT-I	4 Hrs

Generative AI: Introduction to Generative AI, Evolution of Generative AI, Applications of Generative AI, Ethical issues and bias in AI systems

Fundamentals: Latent variable models, Probability distributions, Optimization techniques, Basics of Neural Networks and Transformer architecture

UNIT-II	4 Hrs

Generative Models: Transformer architecture, Autoregressive text generation, Introduction to GANs, Generator and Discriminator

Large Language Models: Introduction to VAEs, Overview of Large Language Models (LLMs), Applications of LLMs

UNIT-III	4 Hrs

Advanced Generative Models: Conditional VAEs, Diffusion Models, Flow-based Models

Applications: Image generation using diffusion models, Applications of advanced generative models in real-world scenarios

UNIT-IV	4 Hrs

Prompt Engineering: Zero-shot, Few-shot and Multi-shot prompting, Chain-of-Thought prompting, Retrieval-Augmented Generation (RAG)

AI Tools & Ethics: ChatGPT, DALL·E, Claude, GitHub Copilot, Prompt evaluation, Responsible AI, Bias mitigation and ethical considerations

LABORATORY COMPONENT

List of Experiments

1. Explore Generative AI tools by performing text generation, summarization, translation, and question answering using ChatGPT or similar Large Language Models (LLMs)
2. Design and evaluate Zero-shot, Few-shot, and Multi-shot prompts for various text generation and reasoning tasks
3. Develop prompts using Chain-of-Thought (CoT) prompting and compare the generated outputs with standard prompting techniques
4. Implement a simple Retrieval-Augmented Generation (RAG) application using an LLM and a custom knowledge base
5. Generate images using diffusion-based Generative AI tools such as DALL·E or Stable Diffusion and evaluate the effect of prompt engineering
6. Explore pre-trained transformer models (GPT/BERT/Hugging Face Transformers) for text generation, text completion, and sentiment analysis
7. Develop a simple Generative AI application using the OpenAI API or Hugging Face Transformers API for text or image generation.
8. Analyze ethical issues in Generative AI by identifying hallucinations, bias, and unsafe outputs, and refine prompts to generate responsible AI responses

Textbook:

1. Foster,D(2023) Generative Deep Learning: Teaching Machines to Paint,Write, Compose, and Play (2nd ed) O'Reilly Media, Inc ISBN: 9781098134181
2. Chip Huyen, **AI Engineering: Building Applications with Foundation Models**, O'Reilly Media, 2025.

Reference Book(s):

1. Ganguly, K (2020) Learning Generative Adversarial Networks Packt Publishing ISBN: 9781839216350
2. Goodfellow, I, Bengio, Y, & Courville, A (2016) Deep Learning Cambridge, MA: MIT Press ISBN: 9780262035613
3. Langr,J,&Bok,V(2019) GANs in Action: Deep Learning with Generative Adversarial Networks Manning Publications ISBN: 9781617295560
4. Lewis Tunstall, Leandro von Werra, and Thomas Wolf, Natural Language Processing with Transformers, O'Reilly Media, 2022.
5. Sebastian Raschka, Build a Large Language Model (From Scratch), Manning Publications, 2024.

Web and Video link(s):

NPTEL Deep Learning – Part 2 (Generative Models) , NPTEL Video Lectures on Deep Generative Models, VAEs, GANs, and Autoregressive Models by Prof Mitesh M Khapra, IIT Madras

Laboratory Manual (for laboratory component):

Prompt Egieering *laboratory manual,* Department of CSE(N), KITSW

Course Articulation Matrix (CAM):		U24IN614X: PROMPT ENGINEERING												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24IN614X.1	2	2	1	1	1	-	-	1	-	1	-	2	2
CO2	U24IN614X.2	2	2	2	2	2	-	-	1	-	1	-	2	2
CO3	U24IN614X.3	2	2	2	2	3	-	-	1	-	1	-	2	2
CO4	U24IN614X.4	2	2	2	2	3	-	-	1	-	1	-	2	2
CO5	U24IN614X.5	2	2	3	2	3	–	–	2	2	2	–	3	3
CO6	U24IN614X.6	2	2	3	3	3	–	–	2	2	2	–	3	3
CO7	U24IN614X.7	2	2	3	2	3	–	–	2	2	2	–	3	3
CO8	U24IN614X.8	2	2	2	3	2	-	-	3	2	2	–	2	2
U24IN614X		2	2	2.25	2.12	2.5	-	-	1.62	2	1.5	-	2.37	2.25
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	explain the fundamentals of generative ai, generative models, and their applications in various domains	SDG9	Industry, Innovation and Infrastructure	Generative AI technologies promote innovation in industries through intelligent automation, content generation, and advanced AI-driven solutions
CO2	analyze autoregressive models, transformers, gans, gpt, and bert architectures for intelligent content generation	SDG4	Quality Education	Advanced generative models support personalized learning systems, intelligent tutoring, and automated educational content generation
CO3	apply vaes, diffusion models, and flow-based models to develop real-world generative ai applications	SDG9	Industry, Innovation and Infrastructure	Generative models are widely used in healthcare, automation, design, and smart systems, enhancing industrial innovation and research capabilities
CO4	design effective prompts and optimize generative ai systems using prompt engineering techniques while addressing ethical concerns	SDG16	Peace, Justice and Strong Institutions	Ethical prompt engineering and bias mitigation help develop responsible AI systems that ensure fairness, transparency, and trustworthy AI deployment
CO5	apply prompt engineering techniques, including zero-shot, few-shot, multi-shot, and chain-of-thought (cot) prompting, to generate accurate and context-aware responses using large language models (llms)	SDG 4, SDG 9	Quality Education; Industry, Innovation and Infrastructure	Prompt engineering enhances AI-assisted learning and supports the development of innovative AI applications
CO6	develop generative ai applications using pre-trained transformer models, retrieval-augmented generation (rag), and apis for text and image generation	SDG 9	Industry, Innovation and Infrastructure	Developing Generative AI applications promotes technological innovation and intelligent digital infrastructure
CO7	utilize generative ai tools and frameworks to perform text generation, summarization, translation, question answering, sentiment analysis, and image generation for real-world applications	SDG 4, SDG 9	Quality Education; Industry, Innovation and Infrastructure	AI tools improve learning, communication, productivity, and support innovative solutions across multiple domains
CO8	evaluate the performance, reliability, and ethical implications of generative ai systems by analyzing hallucinations, bias, unsafe outputs, and responsible ai practices	SDG 16	Peace, Justice and Strong Institutions	Responsible AI practices promote fairness, transparency, accountability, and trustworthy AI systems

VII SEMESTER (STREAM -II)

S No	Category	Course Code	Course Title	Lectures / week				Credits
				L	T	P	E	C
1	OE	U24OE701X -MB	Open Elective –MB	2	1	-	3	3
2	PEC	U24IN702	Program Elective - II/ MOOCs-II	2	1	-	3	3
3	PCC	U24IN703	Privacy and Security in IoT	2	1		3	3
4	PCC	U24IN704	Fundamentals of Quantum Computing	2	1	-	3	3
5	PCC	U24IN705	Drone Systems and Control	2	1	-	3	3
6	PCC	U24IN706	Fundamentals of Quantum ComputingLaboratory	-	-	2	2	1
7	ELC	U24IN707	Internship Evaluation	-	-	2	2	1
8	ELC	U24IN708	Major Project Phase-1 / Industrial Internship -1	-	-	8	8	4
Total:				10	5	12	27	21
Additional Learning@:Maximum credits allowed for Honours/Minor				-	-	-	-	4
Total credits for Honours/Minor students:				-	-	-	-	25

Pool -XX Management Courses Basket (OE-MB)		
S No	**Course Code**	**Course Title**
1	U24OE701A-MB	Management Economics and Accountancy
2	U24OE701B-MB	Engineering Finance
3	U24OE701C-MB	OrganizationalBehavior
4	U24OE701D-MB	E-Commerce and Digital Marketing
5	U24OE701Z-MB	Any other course approved by BoS Chair and Dean AA

Program Elective –II/MOOCS=II		
S No	**Course Code**	**Course Title**
1	**U24IN702A**	Natural Language Processing
2	**U24IN702B**	Platforms and Systems Security
3	**U24IN702C**	Principles of Data Science

MANAGEMENT ECONOMICS AND ACCOUNTANCY			
Class: B. Tech. VII Semester		**Branch: CSE, ECE, ECI, EEE/ CSN, CSO, CSM, CSD, IT, CE, ME**	
Course Code:	**U24OE701A-MB**	**Credits:**	**3**
Hours/Week (L-T-P- E):	**2-1-0-3**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1 : comprehend the basic concepts of management, functions of management

CO2 : distinguish between micro & macroeconomics & forms of business organizations

CO3 : pass journal entries & post them into ledgers, prepare profit & loss accounts and assesses the financial position through the balance sheet

CO4 : evaluate financial statements with a the help of various ratios and reveal the financial health of the organization

UNIT-I	**9 Hrs**

Introduction to Management: Concept of Management, Features of Management, Importance of Management, Nature andScope of Management, Fayol's Administrative Management,Taylor's Scientific Management

Functions of Management: Planning- Concept of Planning, Nature of Planning, Importance of Planning, Planning Process, Types of Planning, **Organizing**-Concept of Organizing, Organization Structure- line and staff,Advantages of Organizing,**Staffing** - Meaning, Functions ofHuman Resources Management,**Directing**- Elements of Directing- Supervision, Leadership-Nature, Motivation - Nature, Types, Communication- Process, Types, Barriers to effective communication,

Co-ordination- Definition, Steps to achieve effective coordination,**Controlling**- Definition, Process

UNIT-II	**9 Hrs**

Economics: Meaning and definition, Scope, Micro and Macro Economics, Methods of Economics

Forms of Business Organization: Sole Proprietor ship, Partnership firm - Types of Partners, Limited Liability Partnership (LLP), Joint Stock Company - Features, Types, Merits and demerits, Cooperative society

UNIT-III	**9 Hrs**

Introduction to Financial Accounting: Accounting concepts and conventions, Double Entry System and Book Keeping, Overview of accounting cycle, Journal-meaning, Journalizing, Ledger - Meaning, Ledger posting, Balancing, Cash book (Single column), Preparation of Trial balance

Final Accounts: Trading Account, profit and loss account and Balance Sheet with simple adjustments

UNIT-IV	**9 Hrs**

Financial Statement Analysis: Introduction to Financial Statement Analysis**,** Ratio Analysis, Introduction, Types of Ratios, Analysis and Interpretation of Liquidity Ratios, Profitability ratios, Activity Ratios, and Capital structure Ratios (simple problems)

Textbook(s):

1. L.M.Prasad, *Principles and Practices of Management,* Sultan Chand & Sons Educational Publishers, 11th edition2025, New Delhi (Part –I to Part-VI)
2. D. N. Dwivedi, *Engineering Economics*: *Text & Cases*, Vikas Publishing, 5th edition, 2014 (Chapter-3)
3. R. Narayana Swamy, *Financial Accounting – A Managerial Perspective*, Prentice Hall of India,

7th edition, 2023, New Delhi(Chapter VI)
Reference Book(s): 1. Harold Koontz and Heinz Weihrich, Essentials of Management, 6th ed New Delhi: Tata Mc Graw Hill Publications, 2015 2. Maheshwari, S N, & Maheshwari, S K (2024) Financial Accounting (7th ed) Vikas Publishing House Pvt Ltd, 2024
Web and Video link(s): 1. https://onlinecoursesnptelacin/e-learning/preview/noc25_mg52 2. https://onlinecoursesnptelacin/e-learning/preview/noc25_ec10

Course Articulation Matrix (CAM):		MANAGEMENT ECONOMICS AND ACCOUNTANCY												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24MB701A-MB.1	-	3	3	2	-	2	2	3	3	3	3	1	1
CO2	U24MB701A-MB.2	-	2	2	1	-	2	3	3	3	3	3	1	1
CO3	U24MB701A-MB.3	-	1	2	1	-	2	3	2	3	3	3	1	1
CO4	U24MB701A-MB.4	-	2	2	2	-	1	2	2	3	3	3	1	1
		-	2	2.25	1.5	-	1.75	2.5	2.5	3	3	3	1	1
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	comprehend the basic concepts of management	SDG 4	Quality Education	Understanding the management concepts and managerial function will help the students to take effective and efficient decisions and able to solve work place problems
CO2	distinguish between micro & macro- economics & forms of business organizations	SDG 8	Decent Work and Economic Growth	Economics concepts will help to promote sustained, inclusive and sustainable economic growth, and different forms of organizations will provide knowledge about creating full and productive employment and decent work for all
CO3	pass journal entries & post them into ledgers, prepare profit & loss accounts and assesses the financial position through the balance sheet	SDG 17	Partnerships for the goals	accounting concepts and conventions will promote a universal, rules-based, open, non-discriminatory and equitable application of
CO4	evaluate financial statements with a the help of various ratios and reveal the financial health of the organization	SDG 8	Decent Work and Economic Growth	Evaluating financial statements through ratio analysis reveals the financial health of an organization, enabling better decision-making, efficient resource utilization, and sustainable growth

ENGINEERING FINANCE			
Class: B.Tech. VII-Semester		**Branch:**CSE, ECE, ECI, EEE/ CSN, CSO, CSM,CSD, IT,CE, and ME	
Course Code:	**U24OE701B-MB**	**Credits:**	**3**
Hours/Week (L-T-P-E):	**2-1-0-3**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1: explain fundamentals of engineering finance, financial management objectives, ethics, and time value of money concept

CO2 : apply capital budgeting techniques including inflation adjusted Net Present Value/Internal Rate Return for project evaluation and selection

CO3: analyse various cost concepts and determine breakeven point for make or buy decisions in engineering projects

CO4: evaluate asset replacement decisions and apply depreciation methods to determine the economic life and value of engineering assets

UNIT-I	**9 Hrs**

Fundamentals of Engineering Finance: Engineering Finance – Meaning, Definition, and Scope, Role of Finance in Engineering – Importance for engineers in decision makingand cost control, Ethics in Engineering Finance – Transparency, Cost estimation honesty, Avoidance of financial conflicts of interest, Financial Management – Meaning,Functions,Objectives (profit maximization v/s wealth maximization),Sources of Finance, Time value of Money

UNIT-II	**9 Hrs**

Investment Decisions: Investment Decisions- Types of Investment projects, Investment evaluation criteria, Methods of capital budgeting – Discounted cash flow techniques v/s non discounted cash flow techniques, Inflation adjusted NPV and IRR, Comparison and selection of mutually exclusive engineering projects

UNIT-III	**9 Hrs**

Cost-Volume-Profit Analysis: Cost concepts- Fixed, Variable, Marginal, Sunk, Opportunity costs, Direct and Indirect costs, Breakeven analysis – Meaning, Assumptions, Graphical and Mathematical determination of breakeven point, Make or buy decisions using breakeven analysis, Application of breakeven analysis in engineering projects

UNIT-IV	**9 Hrs**

Replacement Decisions and Valuation of engineering assets: Replacement analysis – Meaning,Need, Defender v/sChallenger concept, Economic service life, Valuation of equipment's and physical assets -Depreciation definition,Depreciation fund, Methods of depreciation - straight line, Declining balance, Sum of the years-digits, Sinking fund and Service output method, Application of depreciation methods on equipment's and physical asset with the passage of time

Textbook(s):

1. M..Y. Khan and P. K. Jain, *Financial Management,* Tata Mc.Graw Hill 5th edition, ISBN:978-0-07-065614-7 *(Unit-I in part 1 of section 1,2&3 and Unit-II in part 3 of 9&10)*
2. R. Panneerselvam, *Engineering Economics,* PHI Learning 2nd edition, ISBN:978-81-203-4837-0*(Unit-III in Chapter1&16 and Unit-IV in Chapter 8& 9)*

Reference Book(s):

1. F.K. Crundwell, *Finance for Engineers: Evaluation and Funding of Capital Projects*, Springer London Ltd., Atlantic Publishers and Distributors (P) Ltd, ISBN: 978-1849967082, 2010
2. Robert L. Kosowski, Salih N Neftci, *Principles of financial engineering*, Academic press, Atlantic Publishers and Distributors (P) Ltd 3rd edition, ISBN: 978-0123869685, 2014
3. D. N. Dwivedi, *Engineering Economics: Text & Cases*,Vikas Publishing, 5thedition, ISBN: 9788126510887, 2014
4. Prasanna Chandhra, *Financial Management: Theory and Practice,* Tata Mc Graw Hill Education (India) private limited, ISBN-10: 93-392-1225-8, 2015
5. Chan S Park, *Fundamentals of Engineering Economics,* Pearson Education 3rd edition, ISBN: 978-9352864379, 2017
6. Chatterjee Partha Sheikh Salim, *Engineering Economy & Financial Management*, Himalaya Publishing House, ISBN:978-9350247389, 2011

Course Articulation Matrix (CAM):		**U24OE701B: ENGINEERING FINANCE**												
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**
CO1	**U24OE701B-MB**	2	3	2	2	2	2	2	2	-	2	2	1	1
CO2	**U24OE701B-MB**	2	3	2	2	2	2	2	2	-	2	3	1	1
CO3	**U24OE701B-MB**	2	3	2	2	2	2	2	2	-	2	2	1	1
CO4	**U24OE701B-MB**	2	3	2	2	2	2	2	2	-	2	2	1	1
		2	3	2	2	2	2	2	2	-	2	2.25	1	1
3–HIGH, 2–MEDIUM, 1–LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	explain fundamentals of engineering finance, financial management objectives, ethics, and time value of money concept	SDG 4 And SDG 16	Quality Education and Peace, Justice and Strong Institutions	Promotes financial literacy, ethical decision-making, and professional responsibility essential for quality education and transparent institutional practices
CO2	apply capital budgeting techniques including inflation adjusted npv/irr for project evaluation and selection	SDG 8 And SDG 9	Decent Work and Economic Growth And Industry, Innovation and Infrastructure	Supports economically viable investment decisions, efficient resource allocation, industrial growth, and sustainable infrastructure development
CO3	analyse various cost concepts and determine breakeven point for make or buy decisions in engineering projects	SDG 9 And SDG 12	Industry, Innovation and Infrastructure and Responsible Consumption and Production	Encourages cost efficiency, optimized production planning, and responsible utilization of resources in engineering and industrial projects
CO4	evaluate asset replacement decisions and apply depreciation methods to determine the economic life and value of engineering assets	SDG 8 And SDG 12	Decent Work and Economic Growth and Responsible Consumption and Production	Promotes sustainable asset management, economic efficiency, lifecycle optimization, and responsible use of engineering resources

ORGANIZATIONAL BEHAVIOUR			
Class: B. Tech. VII – Semester		**Branch:** CSE,ECE,ECI,EEE/ CSN,CSO,CSM,CSD,IT,CE,ME	
Course Code:	**U24OE701C-MB**	**Credits:**	**3**
Hours/Week (L-T-P- E):	**2-1-0-3**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1 : evaluate the fundamentals, importance, influencing factors, and communication processes of Organizational Behaviour

CO2 : analyse individual behaviour including personality, perception, learning, attitudes, emotions, stress, and motivation

CO3 : examine group behaviour, team effectiveness, conflict management, leadership, power, politics, and group dynamics in organizational settings

CO4 : evaluate organizational structure, culture, innovation, change, organizational effectiveness, quality of work life, and international organizational behaviour

UNIT-I	**9 Hrs**

Introduction: Foundations of organizational behavior, Concept, Importance, Factors influencing organizational behavior, Challenges and opportunities for organization behavior, Managerial perspective of OB, Communication-Process-channels-communication barriers , Measures to overcome barriers

UNIT-II	**9 Hrs**

Individual Behavior: Individual in the organization, Nature of man, Models of man, Personality-Stages of development of personality, Perception-Factors influencing perception, Learning-Theories of Learning-Cognitive Learning Theory, Behaviourist Learning Theory, Attitudes-Formation of attitudes, Personality and emotions, Managing emotions and stress in organizations, Motivation- Motivation theories-Maslow's Needs Hierarchy Theory and Herzberg's Two-Factor Theory

UNIT-III	**9 Hrs**

Group decision making: Groups in organization, Basic group concepts, Groups vs Teams, Understanding work teams-Types of teams, Creating effective teams, Conflicts-Types of conflicts, Strategies for resolution of conflicts in groups

Group dynamics: Group dynamics, Leadership-Leadership types and managerial effectiveness, Trust and leadership, Power and politics, Basis of power, Organizational politics

UNIT-IV	**9 Hrs**

Organization structure: Organization structure, Size and design, Organizational culture, Organizational change-Resistance to change, Organizational stress- Factors contribute to stress, Coping strategies, Stress and performance, Organizational effectiveness-concepts, Quality of work life-concepts, International organizational behavior-concepts

Textbook(s):

1. Stephen P Robbins, Timothy A Judge & Neharika Vohra, *Organizational Behavior, Pearson India, 18th edition*, 2022, New Delhi (Chapter I to IV)
2. K Aswathappa, *Organizational Behaviour, Himalaya Publishing House, 14th edition*, 2021, Mumbai (Chapter I to IV)

Reference Book(s):

1. Fred Luthans, *Organizational Behavior, McGraw Hill Education, 13th edition*, 2020, New York

2. Uma Sekaran, *Organizational Behavior: Text and Cases, McGraw Hill Education, 2nd edition*, 2019, New Delhi
3. S. S. Khanka, *Organizational Behavior, S Chand Publishing, 11th edition*, 2021, New Delhi

Web and Video link(s):

1. Harvard Business Review – Organizational Behavior Articles and Videos, Web resources and expert videos on leadership, teamwork, communication, conflict management, and organizational effectiveness

Course Articulation Matrix (CAM):		U24OE701C-MB ORGANIZATIONAL BEHAVIOUR												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24OE701C-MB	2	-	-	-	-	-	-	2	2	-	-	1	1
CO2	U24OE701C-MB	-	3	-	-	-	-	2	--	-	-	3	1	1
CO3	U24OE701C-MB	-	2	-	-	-	-	-	2	2	2	-	1	1
CO4	U24OE701C-MB	-	-	2	-	-	2	-	-	-	2	2	1	1
U24OE701C-MB		2	2.5	2	-	-	2	2	2	2	2	2.5	1	1
3 – HIGH, 2 – MEDIUM, 1 – LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	explain the fundamentals, importance, influencing factors, and communication processes of organizational behaviour	SDG 4	Quality Education	Understanding organizational behaviour and communication processes helps students develop professional knowledge, communication, and workplace learning skills
CO2	analyse individual behaviour including personality, perception, learning, attitudes, emotions, stress, and motivation	SDG 3	Good Health and Well-being	Analysing emotions, stress, motivation, and attitudes promotes mental well-being, self-management, and healthy work practices
CO3	examine group behaviour, team effectiveness, conflict management, leadership, power, politics, and group dynamics in organizational settings	SDG 16	Peace, Justice and Strong Institutions	Studying leadership, conflict management, teamwork, and group dynamics supports inclusive, cooperative, and effective organizational practices
CO4	evaluate organizational structure, culture, innovation, change, organizational effectiveness, quality of work life, and international organizational behaviour	SDG 8	Decent Work and Economic Growth	Evaluating organizational culture, innovation, quality of work life, and change management supports productive employment and sustainable organizational growth

E-COMMERCE & DIGITAL MARKETING			
Class: B. Tech. VII – Semester		**Branch:**CSE,ECE,ECI,EEE/ CSN,CSO,CSM,CSD,IT,CE,ME	
Course Code:	**U24OE701D-MB**	**Credits:**	**3**
Hours/Week (L-T-P- E):	**2-1-0-3**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1 : interpret the concepts, scope, types, functions, framework, opportunities, and limitations of E-Commerce, and analyse its role in modern business and electronic transactions

CO2 : analyze e-payment systems, e-finance operations, e-banking, e-trading, and the legal framework governing e-commerce transactions

CO3 : evaluate digital marketing practices, emerging trends, and consumer behaviour in the online environment

CO4 : determine digital marketing channels and design effective online marketing plans

UNIT-I	**9 Hrs**

Introduction to E-Commerce: E-commerce – introduction, Definition, Scope, Evolution, internet commerce vs e-commerce, Electronic commerce market, E-commerce industry framework, Trade cycle in e-commerce, electronic data interchange (edi), E-commerce functions, Types of e-commerce – B2B, B2C, C2C, C2B, B2G, G2B, and G2C, forces fuelling e-commerce – Differences between traditional commerce and e-commerce, Limitations of e-commerce, Introduction to artificial intelligence (AI) in e-commerce

UNIT-II	**9 Hrs**

E-payment Systems: Digital payment Requirements, Types of E-Payment Systems - Digital Token-based E-payment systems, Credit card as E-payment system, Mobile payments, smart card cash payment system, Micropayment system, E-Security, E- Cash, E-Finance: Areas of Financing, E-Banking - Traditional Banking Vs E-Banking, Operations in E-Banking, E-Trading – Stock Market trading, Importance and advantages of E-Trading

Legal Framework for E-Commerce: E-Commerce Legal Framework - The Information Technology Act 2000, Information Technology (Amendment) Act, 2008, Copyrights, Defamation, Privacy, Contracts, Taxation, Signing a contract Electronically, Domain name and Registration

UNIT-III	**9 Hrs**

Digital Marketing: Concept, Components of Digital Marketing, Need and Scope of Digital Marketing, Benefits of Digital Marketing, Digital Marketing Platforms and Strategies, Comparison of Marketing and Digital Marketing, Digital Marketing Trends, Marketing in the Digital Era: Segmentation – Importance of Audience Segmentation, different segments used in Digital Media – Organizational characteristics, purchasing characteristics, using Digital Media to Reach, acquisition and retention of new customers, Digital Media for Customer Loyalty

UNIT-IV	**9 Hrs**

Channels of Digital Marketing: Digital Marketing, Website Marketing, Search Engine Marketing, Search Engine optimization, Online Advertising, Email Marketing-Campaign Design, Automation, Personalization, Blog Marketing-Content Creation, Blogging Platforms, Social Media Marketing-Marketing through Facebook, Instagram, LinkedIn, X (Twitter), and

youtube, Audio, Video and Interactive Marketing, Mobile Marketing, Digital Marketing Plan: Need for Digital Marketing Plan, Elements of Digital Marketing Plan, Writing the Marketing Plan and Implementation

Textbook(s):

1. C S V Murthy- *E-Commerce: Concepts, Models & Strategies*, Himalaya Publishing House 2nd Edition (2025)
2. Seema Gupta – *Digital Marketing*, McGraw-Hill 3rd Edition, 2022/2023
3. Tracy L Tuten & Michael R Solomon – *Social Media Marketing*, SAGE Publication, 5th Edition, 2023

Reference Book(S):

1. Matthew Reynolds – *Beginning E-Commerce with Visual Basic, ASP, SQL Server 70 & MTS*, published by Wrox Publisher
2. P T Joseph, SJ *E-Commerce: An Indian Perspective, Latest Edition*: 7th Edition (2023) Publisher: PHI Learning Pvt Ltd
3. Michael Miller – *B2B Digital Marketing: Using the Web to Market Directly to Businesses* 1st Edition (2012, Indian reprint 2014/2015) Pearson India / Que Publishing

Web and Video link(s):

1. **https://youtube/qnBhOVH1QQ8?si=6UtzpR5d6t8Rk5daDigital Marketing Full Course 2026 In 24 Hrs | Digital Marketing Tutorial For Beginners**
2. https://youtube/qsO_YCjgBFI?si=zVdKwrU8l6eEr4wg

Course Articulation Matrix (CAM):		U24OE701D-MB:E-COMMERCE & DIGITAL MARKETING												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24OE701D-MB.1	2	2	1	1	2	1	1	-	1	-	2	1	1
CO2	U24OE701D-MB.2	2	2	1	1	2	2	1	-	1	1	1	1	1
CO3	U24OE701D-MB.3	2	2	2	1	2	1	1	1	2	1	2	1	1
CO4	U24OE701D-MB.4	2	2	2	2	2	1	1	2	2	2	2	1	1
U24OE701D-MB		**2**	**2**	**1.5**	**1.25**	**2**	**1.25**	**1**	**1.5**	**1.5**	**2**	**1.75**	**1**	1
3 – HIGH, 2 – MEDIUM, 1 – LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	understand theconcepts, scope, types, functions, framework, opportunities, and limitations of e-commerce, and analyse its role in modern business and electronic transactions	**SDG 8**	Decent Work and Economic Growth	E-Commerce promotes entrepreneurship, digital business growth, employment opportunities, and innovation in the global economy
CO2	analyse e-payment systems, e-finance operations, e-banking, e-trading, and the legal framework governing e-commerce transactions	**SDG 9**	Industry, Innovation and Infrastructure	Digital payment systems and e-banking strengthen technological infrastructure, financial inclusion, and innovation in digital industries
CO3	evaluate digital marketing practices, emerging trends, and consumer behaviour in the online environment	**SDG 12**	Responsible Consumption and Production	Digital marketing helps organizations understand consumer behaviour and promote sustainable and responsible consumption patterns
CO4	analyzedigital marketing channels and design effective online marketing plans	**SDG 17**	Partnerships for the Goals	Digital marketing channels improve global communication, collaboration, networking, and partnerships among businesses and stakeholders

NATURAL LANGUAGE PROCESSING			
Class: B. Tech. VII – Semester		**Branch:** CSE (IoT)	
Course Code:	**U24IN702A**	**Credits:**	**3**
Hours/Week (L-T-P- E):	**2-1-0-3**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1 : make use of the essential concepts of natural language processing to train a machine to understand text and spoken words in much the same way human beings can understand

CO2 : analyse language models, naïve bayes and sentiment classifiers to recommend an opinion model

CO3 : apply the part of speech tagging and parsing techniques to automate the system responses

CO4 : analyse and develop different applications based on natural language processing such as named entity recognition, question answering, machine translation and chat bots

UNIT-I	9 Hrs

Natural Language Processing (NLP): Introduction to NLP, Ambiguity, Language, ThoughtandUnderstanding

Regular Expressions, Text Normalization, Edit Distance: Regular Expression, Words, Morphology, Morphology parsing, Word tokenization, Lemmatization, Stemming, Edit distance

UNIT-II	9 Hrs

N-gram Language Models: N-Grams, Evaluating language models and smoothing, Kneser-Ney smoothing, Perplexity's relation to entropy

Naïve Bayes and Sentiment Classification: Naïve bayes classifiers, Training the naïve bayes classifier, Worked example, Optimizing for sentiment analysis

UNIT-III	9 Hrs

Sequence Labelling for Parts of Speech and Named Entities: English word classes, Part-of-Speech tagging, Named entities and Named entity tagging, Hidden markov models (HMM)part-of-speech tagging

Constituency Parsing: Ambiguity, Cocke-kasami-younger(CKY) parsing, Partial parsing

UNIT-IV	9 Hrs

Compositional Semantics: Introduction, Semantic role labelling and Semantic parsing, Discourse analysis

Applications: Named entity recognition and relation extraction-IE using sequence labeling – Machine Translation(MT) – Basic issues in MT-Statistical translation-word alignment-phrase – based translation-question answering, Chatbots and dialog system

Textbook(s):

1. Daniel Jurafsky and James HMartin, *Speech and Language Processing*, Pearson Education, 3rd edition, ISBN: 0-13-095069-6, 2009

Reference Book(s):

1. Steven Bird, Ewan Klein and Edward Loper, *Natural Processing with Python*, O'Reilly Media, 1st edition, ISBN: 978-0596516499, 2009
2. Roland RHausser, *Foundations of Computational Linguistics: Human-Computer Communication in Natural Language*, MIT Press 1stedition, ISBN: 978-3540424178, 2011

Web and Video link(s):

http://wwwdigimatin/nptel/courses/video/106101007/106101007html, *NPTEL Video Lecture on Natural Language Processing by Prof. Pushpak Bhattacharya, Professor of CSE, IIT Bombay*

Course Articulation Matrix (CAM):		U24IN702A : NATURAL LANGUAGE PROCESSING												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24IN702A.1	3	1	–	–	3	–	–	–	–	–	2	3	2
CO2	U24IN702A.2	2	3	–	3	3	–	–	–	–	–	2	3	2
CO3	U24IN702A.3	2	2	3	–	3	–	–	–	2	–	2	3	2
CO4	U24IN702A.4	2	3	3	3	3	–	–	–	2	–	3	3	2
U24IN702A		2.25	2.25	3	3	3	-	-	-	2	-	2.25	3	2
3 – HIGH, 2 – MEDIUM, 1 – LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	make use of the essential concepts of natural language processing to train a machine to understand text and spoken words in much the same way human beings can understand	**SDG 4**	Quality Education	NLP enables intelligent learning systems, language translation, and accessible educational technologies
CO2	analyse language models, naïve bayes and sentiment classifiers to recommend an opinion model	**SDG 9**	Industry, Innovation and Infrastructure	Sentiment analysis and language models support AI-based industrial and innovative applications
CO3	apply the part of speech tagging and parsing techniques to automate the system responses	**SDG 10**	Reduced Inequalities	Automated language processing improves communication accessibility across diverse linguistic groups
CO4	analyse and develop different applications based on natural language processing such as named entity recognition, question answering, machine translation and chat bots	**SDG 17**	Partnerships for the Goals	NLP applications enhance global communication, collaboration, and multilingual interaction

PLATFORMS AND SYSTEMS SECURITY			
Class: B. Tech. VII – Semester		**Branch:** CSE (IoT)	
Course Code:	**U24IN702B**	**Credits:**	**3**
Hours/Week (L-T-P- E):	**2-1-0-3**	**CIE:**	**40%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**60%**

Course Learning Outcomes (LOs)

After completion of this course, the students should be able to,

CO1: understand the principles, threats, and security mechanisms of computing platforms and systems

CO2: analyze operating system security, access control, and platform hardening techniques

CO3: apply secure design principles and threat modeling to develop secure systems

CO4: evaluate security mechanisms for virtualization, cloud platforms, and enterprise infrastructure

UNIT-I	**9Hrs**

Fundamentals of Platforms and Systems Security: Introduction, Security Goals (CIA), Security policies and models, Threats, Vulnerabilities and risk assessment, Attack surface analysis, Attack trees, Security design principles, Trusted computing concepts, Hardware Root of Trust, Secure Boot, Trusted Platform Module (TPM), Security Architecture of Modern Computing Platforms, Security Governance and Risk Management

UNIT-II	**9 Hrs**

Operating System Security: Security Architecture, User Authentication and Account Management, Access Control Models, Process Isolation, Memory Protection, Secure File Systems, Kernel Protection, System Calls and Privilege Management, Windows Security Architecture, Linux Security Architecture, Android Platform Security (overview), Endpoint Hardening, Patch Management, Secure System Configuration

UNIT-III	**9Hrs**

Secure Platform Design and Software Security: Secure by design, Secure by default, Defense in depth, Least privilege, Fail securely, Zero trust principles, Secure configuration baselines, Secure software development lifecycle (SSDLC)

Infrastructure Security: Network Segmentation, Firewalls , IDS/IPS, Secure remote access, VPN technologies

UNIT-IV	**10 Hrs**

Virtualization Security: Hypervisor Security, Virtual Machine Isolation, VM Escape, Secure VM Migration

Container Security: Docker Security Concepts, Kubernetes Security Basics, Container Image Security, Runtime Protection

Cloud Platform Security: Shared Responsibility Model, Cloud Workload Protection, Cloud Security Posture Management, Logging and Monitoring, Security Incident Response, Vulnerability Assessment, Patch and Configuration Management, Business Continuity and Disaster Recovery

Textbook(s):

1. **William Stallings and Lawrie Brown**, *Computer Security: Principles and Practice*, 5th Edition, Pearson Education, 2024
2. **Michael Howard and David LeBlanc**, *Writing Secure Code*, 2nd Edition, Microsoft Press, 2003
3. **Andrew S Tanenbaum and Herbert Bos**, *Modern Operating Systems*, 5th Edition, Pearson, 2023
4. **Tim Mather, Subra Kumaraswamy, and Shahed Latif**, *Cloud Security and Privacy*, 1st Edition, O'Reilly Media, 2009

Reference Book(s):

1. **Ross Anderson**, *Security Engineering: A Guide to Building Dependable Distributed Systems*, 3rd Edition, Wiley, 2020
2. **Mark Graff and Kenneth R Van Wyk**, *Secure Coding: Principles and Practices*, O'Reilly Media, 2003
3. **James Turnbull**, *The Docker Book: Containerization Is the New Virtualization*, Updated Edition

Web and Video link(s):
https://youtube/EoyFJ1km_Mc

Course Articulation Matrix (CAM):		U24IN702B PLATFORMS AND SYSTEMS SECURITY												
CO		PO1	PO2	PO3	PO4	PO5	PO 6	PO 7	PO8	PO 9	PO 10	PO 11	PSO1	PSO2
CO1	U24IN702B.1	3	2	2	2	2	1	-	1	1	1	2	2	3
CO2	U24IN702B.2	3	3	2	2	2	1	-	1	1	1	2	2	3
CO3	U24IN702B.3	2	3	3	2	2	1	-	1	1	1	2	2	3
CO4	U24IN702B.4	2	3	2	3	3	1	-	1	1	1	3	2	3
U24IN702B		**2.5**	**2.75**	**2.25**	**2.25**	**2.25**	**1**	**-**	**1**	**1**	**1**	**2.25**	**2**	**3**

CO–SDG Alignment Matrix				
CO	Course Outcome	Relevant SDG	SDG Description	Mapping Justification
CO1	understand the principles, threats, and security mechanisms of computing platforms and systems	SDG 9	Industry, Innovation and Infrastructure	Builds foundational knowledge for designing secure and resilient computing platforms and digital infrastructure
CO2	analyze operating system security, access control, and platform hardening techniques	SDG 9	Industry, Innovation and Infrastructure	Promotes secure and reliable computing systems that support modern industrial and digital technologies
CO3	apply secure design principles and threat modeling to develop secure systems	SDG 16	Peace, Justice and Strong Institutions	Supports the development of trustworthy and secure software systems that protect digital assets and services
CO4	evaluate security mechanisms for virtualization, cloud platforms, and enterprise infrastructure	SDG 9, SDG 16	Industry, Innovation and Infrastructure, Peace, Justice and Strong Institutions	Enables secure cloud and enterprise infrastructures while strengthening cybersecurity practices for resilient digital ecosystems

PRINCIPLES OF DATA SCIENCE			
Class: B. Tech. VII – Semester		**Branch:** CSE (IoT)	
Course Code:	**U24IN702C**	**Credits:**	**3**
Hours/Week (L-T-P- E):	**2-1-0-3**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1 : explain core data science lifecycles, team profiles, and differentiate primary data repositories

CO2 : apply fundamental R programming operations and statistical frequency distributions to sample datasets

CO3 : choose appropriate retinal encodings and structural variables for mapping complex visualization parameters

CO4 : analyze modern visualization landscapes, interactive Bokeh frameworks, and handle big data analytical constraints

UNIT-I	**9 Hrs**

Introduction to Data Science: Data science, Terminology related with data science, Methods of data repository, Personnel involved with data science, Types of data, The Data Science Process (DSP), Data science project's lifecycle, Popular data science toolkits, Familiarity with example applications

UNIT-II	**9 Hrs**

Data Analysis using R Programming Language: Introduction to applied statistical techniques, Types of statistical data, Types of big data analytics, Collecting data for sampling and distribution, Probability, Frequency distribution, Population and parameters, Central tendency or central value, Measures of central tendency, Different types of statistical means, Problems of estimation, Normal distribution curve

UNIT-III	**9 Hrs**

Data Visualization: Data visualization, Importance of data visualization, Conventional data visualization methods, Retinal variables, Mapping variables to encodings

Applications of Data Science, Technologies for Visualization and Bokeh (Python): Applications of data science technologies for visualization, Introduction to python, Basic numeric operations, Data types in python, Modules, Library, Introduction to Bokeh

UNIT-IV	**9 Hrs**

Recent Trends in Data Science : Recent trends in various data collection and analysis techniques**,** Various big data visualization tools, Visualizing big data, Preattentive attributes, Challenges of big data visualization, Potential solutions, Future progress of big data visualization

Textbook(s):

1. VKJain, *Data Science & Analytics(with Python, R and SPSS Programming)*, New Delhi: Khanna Book Publishing, 2018 (Chapters: 1, 3 to 6)

Reference Book(S):

1. Dr Tirthajyoti Sarkar and Shubhadeep Roychowdhury, *Data Wrangling with Python*, UK: Packt Publishing Ltd,2019

Joel Grus, *Data Science from Scratch*, USA: O'Reilly Media, Inc, 2015Dinesh Kumar, *Business Analytics*, New Delhi: Wiley, 2017
Web and Video link(s): 1. NPTEL Course Link: https://onlinecoursesnptelacin/noc21_ma35/preview Video Lectures: "Essentials of Data Science With R Software" by IIT Faculty

Course Articulation Matrix (CAM):		**U24IN702C: PRINCIPLES OF DATA SCIENCE**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24IN702C.1**	2	2	1	1	1	1	2	1	1	-	1	2	1
CO2	**U24IN702C.2**	3	3	2	2	3	1	2	1	1	-	1	3	2
CO3	**U24IN702C.3**	2	2	2	1	2	1	2	1	1	-	1	2	2
CO4	**U24IN702C.4**	3	3	3	2	3	1	2	1	1	-	2	3	3
U24IN702C		2.5	2.5	2	1.5	2.25	1	2	1	1	-	1.25	2.5	2
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	explain core data science lifecycles, team profiles, and differentiate primary data repositories	SDG9	Industry, Innovation and Infrastructure	Understanding structured data engineering lifecycles and differentiating primary data repositories forms the foundational infrastructure needed to drive analytical innovations within enterprise architectures
CO2	apply fundamental r programming operations and statistical frequency distributions to sample datasets	SDG4	Quality Education	Utilizing scripting platforms like R to evaluate mathematical sample parameters, distributions, and descriptive statistics enhances quantitative logical reasoning and high-level technical competency in engineering education
CO3	choose appropriate retinal encodings and structural variables for mapping complex visualization parameters	SDG11	Sustainable Cities and Communities	Selecting optimal retinal variables and graphics encodings translates massive data trends into interpretable telemetry diagrams, which are vital for real-time traffic, utility monitoring, and smart city applications
CO4	analyze modern visualization landscapes, interactive bokeh frameworks, and handle big data analytical constraints	SDG9	Industry, Innovation and Infrastructure	Evaluating large-scale interactive visualization toolkits (such as Bokeh) enables engineering networks to optimize high-volume data streams, expanding industrial capacity and modern cloud-network automation frameworks

PRIVACY AND SECURITY IN IOT			
Class: B Tech VII – Semester		**Branch:** CSE (IoT)	
Course Code:	**U24IN703**	**Credits:**	**3**
Hours/Week (L-T-P- E):	**2-1-0-3**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1 : understand the fundamentals of IoT security and privacy, analyze IoT threats, attacks, malware propagation, and defense mechanisms in IoT systems

CO2 : analyze privacy preservation techniques, IoT security architectures, cooperative authentication models, and computational security approaches for secure IoT environments

CO3 : apply cryptographic techniques, authentication mechanisms, and key management schemes for securing constrained IoT devices and communication system

CO4 : evaluate secure communication protocols, privacy-preserving techniques, advanced IoT security solutions, and real-world IoT security applications in industrial and smart environments

UNIT-I	9 Hrs

Threats in IoT: Introduction to IoT Security and Privacy, Phases of IoT System, Interconnections of Threats (IoT vs IoT), Phase Attacks and Attacks as per IoT Architecture

Attacks, Defense and Network Robustness of IoT: Centrality Attacks, Network Resilience and Topological Defense Schemes, Game Theoretic Analysis of Network Robustness, Fusion-based Defense Scheme, Sequential Defense Scheme

Malware Propagation and Control in IoT: Introduction to Malware in IoT, Malware Schemes in IoT, Modeling Malware Dynamics from the Individual Viewpoint, Modeling Malware Dynamics from the Network Viewpoint, Optimal Control of Malware

UNIT-II	9 Hrs

Privacy Preservation and IoT Security Architecture: Privacy Preservation Data Dissemination: Network Model, Threat Model, Privacy Scope, Motivation for Privacy and Availability Definition, Uncertainty and Information States, Evaluation Criteria, SPG-based Data Dissemination and Experiment Validation

Architecture Model for IoT Security and Privacy: Limitations of Current Technologies and Emerging Solutions for IoT, Introducing NG as an IoT Architecture

Preventing Unauthorized Access and Computational Security for IoT: Preventing Unauthorized Access to Sensor Data: Bargaining-based Dynamic Game Model for Cooperative Authentication, Analysis of Dynamic Game Model for Cooperative Authentication

UNIT-III	9 Hrs

Cryptography and Authentication for IoT: Introduction to Cryptography for IoT, Security Requirements in Constrained IoT Devices, Symmetric Key Cryptography, Asymmetric Key Cryptography, Lightweight Cryptography for IoT, Elliptic Curve Cryptography (ECC), Hash Functions, Message Authentication Codes (MAC), Digital Signatures

Authentication and Key Management in IoT: Device Authentication, Mutual Authentication, Identity Management, Authorization Mechanisms, Token-based Authentication, Multi-factor Authentication, Secure Session Establishment, Key

Management and Distribution in IoT Networks	
UNIT-IV	**9 Hrs**
Secure Communication Protocols for IoT: Transport Layer Security (TLS) and Datagram TLS (DTLS), Secure IoT Communication Protocols, Secure Firmware Updates and End-to-End Secure Communication **Privacy Preservation and Advanced Security in IoT:** Privacy-preserving Techniques in IoT, Data Privacy and User Privacy in IoT Systems, Privacy-preserving Data Aggregation, Time Series Data Aggregation Schemes, Data Anonymization Techniques, Differential Privacy, Trust Management in IoT, Secure Data Sharing and Access Privacy, Security Analysis and Performance Evaluation of Privacy-preserving Schemes	
Textbook(s): 3. Fei Hu, *Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations*, 1st Edition, CRC Press, New York, 2016 (Chapters 1–4, 6, 11–12, 14, 15, 17) 4. William Stallings, *Cryptography and Network Security*, 7th Edition, Pearson Education, United Kingdom (Chapters: 1-19, 22-23)	
Reference Book(s): 5. Syed Rameem Zahra and Mohammad Ahsan Chishti, *Security and Privacy in the Internet of Things*, 1st Edition, CRC Press, New York, 2021 6. Vijay Madisetti and Arshdeep Bahga, *Internet of Things (A Hands-on Approach)*, 1st Edition, Orient Blackswan Private Limited, New Delhi, 2015 7. Md Husamuddin and Mohammed Qayyum, *Internet of Things: A Study on Security and Privacy Threats*, Proceedings of the 2017 2nd International Conference on Anti-Cyber Crimes (ICACC), 2017 8. Muhammad Aqeel, Fahad Ali, Muhammad Waseem Iqbal, Toqir A Rana, Muhammad Arif and Md Rabiul Auwul, *A Review of Security and Privacy Concerns in the Internet of Things (IoT)*, Hindawi Journal of Sensors, Volume 2022	
Web and Video link(s): https://onlinecoursesnptelacin/noc22_ee116/preview,*NPTEL Video Lecture on Cryptography and Networks Security by Prof Sourav Mukhopadhyay, Professor of CSE, IIT Kharagpur*	

Course Articulation Matrix (CAM):		**U24IN703: PRIVACY AND SECURITY IN IOT**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24IN703.1**	1	2	2	1	1	-	1	-	1	-	2	2	2
CO2	**U24IN703.2**	2	2	2	2	1	-	1	-	1	-	2	2	2
CO3	**U24IN703.3**	2	2	3	2	1	-	1	-	1	-	2	3	3
CO4	**U24IN703.4**	2	2	3	3	1	-	1	-	1	-	2	3	3
U24IN703		1.75	2	2.50	2	1	-	1	-	1	-	2	2.50	2.50
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	understand iot security fundamentals, threats, attacks, malware propagation, and defense mechanisms in iot systems	SDG 9	Industry, Innovation and Infrastructure	Helps students understand secure and resilient IoT infrastructures for industrial and smart technology environments
CO2	analyze privacy preservation techniques, iot security architectures, cooperative authentication models, and computational security approaches for secure iot environments	SDG 16	Peace, Justice and Strong Institutions	Promotes secure digital ecosystems, privacy protection, and trustworthy communication systems in connected environments
CO3	apply cryptographic techniques, authentication mechanisms, and key management schemes for securing constrained iot devices and communication systems	SDG 9	Industry, Innovation and Infrastructure	Supports development of secure communication and authentication mechanisms for reliable IoT-based industrial systems and smart infrastructures
CO4	evaluate secure communication protocols, privacy-preserving techniques, advanced iot security solutions, and real-world iot security applications in industrial and smart environments	SDG 11	Sustainable Cities and Communities	Enables secure deployment of IoT technologies in smart cities, healthcare, smart grids, and sustainable connected communities

FUNDAMENTALS OF QUANTUM COMPUTING

Class: B Tech VII – Semester		**Branch:** CSE (IoT)	
Course Code:	**U24IN704**	**Credits:**	**3**
Hours/Week (L-T-P- E):	**2-1-0-3**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1 : understand the fundamentals of classical and quantum computing principles, qubits, superposition, and measurement

CO2 : apply quantum gates, circuits, and quantum programming techniques using open-source quantum simulators and frameworks

CO3 : analyze entanglement, quantum protocols, and quantum algorithms for computational problem solving

CO4 : analyze the performance and limitations of quantum computing systems, error correction methods, and real-world quantum applications

UNIT-I	**9 Hrs**

Foundations of Classical and Quantum Computing - Introduction to computation,Classical bits and binary systems,Logic gates and reversible computation,Introduction to quantum computing,Qubits and quantum states,Superposition,Complex numbers in quantum computing,Quantum measurement,Bloch sphere representation

UNIT-II	**9 Hrs**

Quantum Programming Frameworks and Basic Quantum Gates - Introduction to Quantum Programming, Overview of Qiskit and PennyLane, Installation and development environment setup, Quantum circuit creation using Qiskit, Basic quantum gates:, Pauli-X Gate, Pauli-Y Gate, Pauli-Z Gate, Hadamard Gate, Phase Gate, CNOT Gate, Quantum circuit visualization, Quantum measurement and simulation, Running circuits on IBM Quantum Simulator, Introduction to hybrid quantum-classical programming using PennyLane

UNIT-III	**9 Hrs**

Quantum Circuits and Quantum Information - Multi-qubit systems, Tensor products, Bell states, Entanglement, Controlled gates (CNOT, Toffoli), Quantum teleportation, Superdense coding, BB84 Protocol, Quantum Fourier Transform

UNIT-IV	**9 Hrs**

Quantum Algorithms and Applications- Deutsch Algorithm, Deutsch–Jozsa Algorithm, Grover's Search Algorithm, Introduction to Shor's Algorithm, Quantum Error Correction, Noise and Decoherence, Applications of Quantum Computing:, Cryptography, Optimization, AI/ML, Healthcare

Textbook:

1. Thomas G Wong, *Introduction to Classical and Quantum Computing*, Rooted Grove Publications, 2022 Chapters: 1, 3 , 5 to 8)

Reference Book(s):

1. Yanofsky NS, Mannucci MA *Quantum computing for computer scientists Cambridge University Press, 2008 Aug 11*
2. Benenti G, Casati G, Strini G *Principles of Quantum Computation and Information*-Volume II: Basic Tools and Special Topics World Scientific Publishing Company, 2007 Mar 21
3. Pittenger AO *An introduction to quantum computing algorithms* Birkhäuser, 1999

Web and Video link(s):

1. https://nptelacin/
2. https://wwwyoutubecom/watch?v=2SPjEA-4lKk&list=PLuBwWyD3M82x9PfxeF7oxb0E122mQAWh6

Course Articulation Matrix (CAM):		U24IN704 :QUANTUM PROGRAMMING AND APPLICATIONS												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24IN704.1	3	2	1	1	1	-	1	-	1	-	2	2	2
CO2	U24IN704.2	3	3	2	2	1	-	1	-	1	-	2	2	2
CO3	U24IN704.3	3	3	2	3	2	-	1	-	1	-	2	2	2
CO4	U24IN704.4	2	3	2	3	2	-	1	-	1	-	2	2	2
U24IN704		2.75	2.75	2.25	2.25	1.5	-	1	-	1	-	2	2	2
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	understand the fundamentals of classical and quantum computing principles, qubits, superposition, and measurement	SDG 4	Quality Education	Quantum computing introduces advanced interdisciplinary knowledge in mathematics, physics, and computing, promoting higher-order learning, innovation, and modern technical education
CO2	apply quantum gates, circuits, and quantum programming techniques using open-source quantum simulators and frameworks	SDG 9	Industry, Innovation and Infrastructure	Qubit implementation technologies contribute to next-generation computational infrastructure and foster innovation in emerging quantum hardware systems
CO3	analyze entanglement, quantum protocols, and quantum algorithms for computational problem solving	SDG 9	Industry, Innovation and Infrastructure	Quantum algorithms support technological advancement in optimization, artificial intelligence, simulation, and computational efficiency for future industries
CO4	analyze the performance and limitations of quantum computing systems, error correction methods, and real-world quantum applications	SDG 16	Peace, Justice and Strong Institutions	Quantum cryptography enhances secure communication, data privacy, and cybersecurity mechanisms that strengthen trustworthy digital systems and institutions

DRONE SYSTEMS AND CONTROL			
Class: B. Tech. VII – Semester		**Branch:** CSE (IoT)	
Course Code:	**U24IN705**	**Credits:**	**3**
Hours/Week (L-T-P- E):	**2-1-0-3**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1 : analyse drone fundamentals, aerodynamic principles, propulsion systems, and multicopter flight control models used in UAV design and operation

CO2 : apply perception, localization, mapping, artificial intelligence, and mission planning techniques for autonomous UAV navigation and multi-UAV systems

CO3 : demonstrate practical drone building activities including component configuration, calibration, thrust testing, and ROS-based UAV development

CO4 : analyse UAV safety regulations, aviation standards, licensing procedures, and drone applications in healthcare, agriculture, and other domains

UNIT-I	**9 Hrs**

Introduction & Modelling: Introduction to drones and basic components, Aerodynamic and Flight dynamics, Drone design, Calculations and Assumptions, Propulsion and Energy management, Anti-vibration and Noise reduction in UAV, Multi copter flight control models

UNIT-II	**9 Hrs**

Perception: Introduction to autonomous navigation, Sensor perception on UAV, Artificial Intelligence and Machine Learning, Localization and Mapping

Mission Decision–Making: Obstacle detection and Avoidance, Mission planning and Path planning, Wireless communication on UAV, Multi UAV systems

UNIT-III	**9 Hrs**

Drone Building Activities Drone Building Activities: Configuring and Calibrating drone components, Thrust stands and Motor/Propeller performance testing, ROS

UNIT-IV	**9 Hrs**

Regulations & Applications: Safety risks, Guidelines to fly safely, specific aviation regulation and standardisation, Drone license, Design of drones for applications such as medical and agriculture

Textbook(s):

1. Daniel Tal and John Altschuld, "Drone Technology in Architecture, Engineering and Construction: A Strategic Guide to Unmanned Aerial Vehicle Operation and Implementation", John Wiley & Sons, Inc, 2021
2. Terry Kilby and Belinda Kilby, "Make: Getting Started with Drones "Maker Media, Inc, 2016

Reference Book(s):

1. Zavrsnik, "Drones and Unmanned Aerial Systems: Legal and Social Implications for Security and Surveillance", Springer, 2018
2. Armand J Chaput, "Design of Unmanned Air Vehicle Systems", Lockheed Martin Aeronautics Company, 2001
3. Reg Austin "Unmanned aircraft systems UAV design, development and deployment", Wiley, 2010
4. Robert C Nelson, Flight Stability and Automatic Control, McGraw-Hill, Inc, 1998

Web and Video link(s):

1. https://nptel.ac.in/
2. https://wwwmathworkscom/solutions/aerospace-defense/uavhtml

Course Articulation Matrix (CAM):		U24IN705 : DRONE SYSTEMS AND CONTROL												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24IN7051	2	2	2	1	2	-	-	1	1	1	-	2	2
CO2	U24IN7052	2	2	2	2	2	-	-	1	1	1	-	2	2
CO3	U24IN7053	2	2	2	2	2	-	-	2	1	1	-	2	2
CO4	U24IN7054	2	2	2	1	1	2	-	1	1	1	-	2	2
U24IN705		2	2	2	1.50	1.75	2	-	1.25	1	1	-	2	2
3 – HIGH, 2 – MEDIUM, 1 – LOW														

CO–SDG Alignment Matrix				
CO	CO Statement *The student should be able to…*	Relevant SDG	SDG Description	Mapping Justification
CO1	analyze drone fundamentals, propulsion systems, and flight control models	SDG9	Industry, Innovation and Infrastructure	Drone technologies support industrial innovation, smart transportation, and intelligent infrastructure development
CO2	apply ai, localization, mapping, and mission planning for uav navigation	SDG11	Sustainable Cities and Communities	Autonomous UAV systems support smart city applications such as surveillance, traffic monitoring, and disaster response
CO3	demonstrate drone building, calibration, and ros-based uav implementation	SDG4	Quality Education	Practical UAV development activities enhance technical and professional engineering skills
CO4	analyze uav regulations, safety, and application-oriented drone systems	SDG3	Good Health and Well-being	Medical drones improve healthcare delivery while safety regulations ensure secure UAV operations

FUNDAMENTALS OF QUANTUM COMPUTING LABORATORY			
Class: B. Tech. VII – Semester		**Branch:** CSE (IoT)	
Course Code:	**U24IN706**	**Credits:**	**1**
Hours/Week (L-T-P- E):	**0-0-2-2**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1 : understand qubits, superposition, and measurement using quantum simulators

CO2 : apply quantum gates and develop quantum circuits using Qiskit tools

CO3 : analyze quantum entanglement, teleportation, and quantum algorithms experimentally

CO4 : analyze practical aspects of quantum programming, error correction, and quantum applications

Experiment-1 (UNIT-I)

Binary Representation and Classical Logic Simulation

1. Binary number representation
2. Logic gate implementation using Python
3. Truth table generation for AND, OR, NOT, XOR gates

Experiment-2 (UNIT-I)

Introduction to Qubits and Superposition

1. Representation of qubits
2. Bloch sphere visualization
3. Superposition using Hadamard gate

Experiment-3 (UNIT-I)

Quantum Measurement

1. Measurement in quantum circuits
2. Probability analysis of qubit states
3. Simulation using Quirk/Qiskit

Experiment-4 (UNIT-II)

Introduction to Qiskit

1. Installation and setup of Qiskit
2. Creating first quantum circuit
3. Running circuits on simulator

Experiment-5 (UNIT-II)

Basic Quantum Gates using Qiskit

1. Implementation of Pauli-X gate
2. Implementation of Pauli-Y and Z gates
3. Hadamard gate implementation

Experiment-6 (UNIT-II)

Introduction to PennyLane

1. PennyLane environment setup
2. Simple hybrid quantum-classical circuit
3. Quantum circuit visualization using PennyLane

Experiment-7 (UNIT-III)

Multi-Qubit Systems and Entanglement

1. Bell state generation
2. Entanglement verification
3. CNOT gate implementation

Experiment-8 (UNIT-III)

Quantum Communication Protocols

1. Quantum teleportation
2. Superdense coding
3. BB84 protocol simulation

Experiment-9 (UNIT-III)

Controlled Quantum Gates

1. Controlled-NOT (CNOT) gate
2. Toffoli gate implementation
3. Multi-qubit circuit design

Experiment-10 (UNIT-IV)

Deutsch and Deutsch–Jozsa Algorithms

1. Implementation of Deutsch algorithm
2. Balanced vs constant function analysis
3. Deutsch–Jozsa circuit simulation

Experiment-11 (UNIT-IV)

Grover's Search Algorithm

1. Oracle construction
2. Amplitude amplification
3. Search space analysis

Experiment-12 (UNIT-IV)

Basic Quantum Applications

1. Quantum random number generator
2. Quantum coin toss simulation
3. Simple Bell-state measurement experiment

Textbook(s):

1. **Thomas G Wong**, *Introduction to Classical and Quantum Computing*, Rooted Grove Publications, 2022

Reference Book(s):

1. **Michael A Nielsen and Isaac L Chuang**, *Quantum Computation and Quantum Information*, Cambridge University Press
2. Rieffel, E, & Polak, W (2011) *Quantum Computing: A Gentle Introduction* MIT Press

Course Articulation Matrix (CAM):		**U24IN706: FUNDAMENTALS OF QUANTUM COMPUTING LABORATORY**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24IN706.1**	3	2	1	1	2	1	1	1	1	1	2	2	1
CO2	**U24IN706.2**	3	3	3	2	3	1	1	2	1	1	2	3	2
CO3	**U24IN706.3**	3	3	2	3	3	1	1	2	1	1	2	3	2
CO4	**U24IN706.4**	2	3	2	3	3	1	1	2	1	1	3	2	2
U24IN706		2.75	2.75	2	2.25	2.25	1	1	1.75	1	1	2.25	2.5	1.75

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	understand qubits, superposition, and measurement using quantum simulators	SDG4	Quality Education	Quantum computing introduces interdisciplinary learning in physics, mathematics, and computing, promoting advanced technical education and modern learning methodologies
CO2	apply quantum gates and develop quantum circuits using Qiskit tools	SDG9	Industry, Innovation and Infrastructure	Quantum programming frameworks and circuit development contribute to emerging computational infrastructure and foster innovation in next-generation computing technologies
CO3	analyze quantum entanglement, teleportation, and quantum algorithms experimentally	SDG9	Industry, Innovation and Infrastructure	Quantum algorithms and communication protocols support advancements in secure communication, optimization, artificial intelligence, and future industrial technologies
CO4	analyze practical aspects of quantum programming, error correction, and quantum applications	SDG16	Peace, Justice and Strong Institutions	Quantum cryptography, secure communication, and error correction mechanisms enhance cybersecurity, trustworthy digital infrastructure, and secure information systems

INTERNSHIP EVALUATION			
Class: B.Tech. VII – Semester		**Branch:** CSN(IoT)	
Course Code:	**U24IN707**	**Credits:**	**1**
Hours/Week (L-T-P- E):	**0-0-2-2**	**CIE:**	**100%**
Total Number of Teaching Hours:	**-**	**ESE:**	

Course Learning Outcomes (COs):

After completion of this course, the students should be able to,

CO1: demonstrate understanding of professional practices, workplace ethics, and organizational functioning through internship experience

CO2: apply engineering knowledge and modern tools to perform assigned tasks and solve real-world problems

CO3: exhibit professional skills including communication, teamwork, leadership, and lifelong learning

CO4: prepare internship reports and effectively communicate internship outcomes through presentations and viva-voce

Mandatory Internships:

1. The internships provide exposure to the real-world, get a feel for the work environment and how a professional workplace operates
2. During the internship, students will experience a real-life engineering workplace and understand how their engineering and professional knowledge, skills, and qualities (KSQs) can be utilized in industry
3. Students can learn, more importantly, how to apply the KSQs they have acquired during an internship to their future workplaces
4. Students will also be able to demonstrate functioning engineering knowledge, both new & existing, and identify areas of further development for their future careers
5. Internships give the student an opportunity to bridge theory and practice
6. Internships also provide students with the soft skills needed at workplace and leadership positions
7. The internship guidelines are governed by the rules stipulated in the Institute's Internship Policy-2020 document
8. The students shall have to undergo 6-8 weeks of mandatory internship during summer/winter vacation at industry/R&D organization / Academic Institutes like IITs, IIITs& NITs
9. HoD, along with Prof i/c internships, shall address students (*of 2nd, 4th and 6th semesters*) during last week of even semester of every academic year on the following
    a. creating awareness on mandatory 6-8 weeks internship by every student
    b. creating awareness on COs of internships
    c. KSQs the students would acquire doing internships
    d. expected internship outcomes
    e. available internship options, and organizations offering internships
    f. progressively completing 6-8 weeks internship by the end of 6th semester summer, starting from 2nd semester summer break

g. internship evaluation in 7th semester

h. internship report submission and oral presentation (through PPT) by student

10. Students undergoing the internship shall be required to submit their details to the department internship coordinators of the respective branches He will coordinate all the internship activities of the students of that department
11. Students have to submit a signed undertaking to the department internship coordinator for demonstrating honesty, integrity, professionalism and regular attendance at work place to add value to the organization where the internship is allotted Students also have to uphold the professional image of our institute
12. In case, a student is found to violate the internship rules and regulations, the student will have to produce a valid reason for the violation of internship rules Without a valid reason, the student will be debarred from taking part in subsequent placement activities of the institute
13. The students preferably shall undergo internship at one organization only In case of any difficulty, the stipulated period of internship shall be completed at different organizations with minimum of one week internship at every stage
14. The internship evaluation shall be done in the VII semester of study and hence the students shall complete the prescribed period of internship before start of VII semester (from end of II semester to commencement of VII semester)
15. The student learning assessment process (SLAP): The SLAP in internships shall include feedback from internship supervisor, submission of internship report on the complete internship and PPT presentation
16. Internship Log Book: The activity journaling in a log book is very important for a successful internship
    a. The internship supervisor identifies the work goals at the beginning of the internship
    b. Student has to maintain internship log book, where in the activities undertaken during internship and timely submission at periodic intervals are to be documented
    c. At the conclusion of the internship, the supervisor shall specifically comment, in the internship log book, on whether the student met each of the work goals and to give evidence which describes the quality of work For student, this also serves as a self- assessment
    d. Internship log book *(with due signatures of the internship supervisor)* shall beconsidered for evaluation during presentation, ie, number of planned meetings with internship supervisor and number attended by student
17. Meeting Cadence:
    i. **Regular meetings with internship supervisor:** Regular meetings with the internship supervisor to discuss work goals and review the status of activities undertaken are very essential Student shall participate in discussions and take notes
    ii. **Meeting Frequency:** The meeting cadence, *ie, meeting frequency* shall be fixed

inconsultation with the internship supervisor and accordingly student has to participate in discussions and take notes Take signatures of internship supervisor as per the planned cadence in the internship log book

18. The internship evaluation shall be done by ***department internship evaluation committee*** **(DIEC)** based on the submitted report by student and oral presentation
19. There shall be only Continuous Internal Evaluation (CIE) for internship evaluation
20. CIE for the Internship evaluation in VII semester shall be as below:

Internship evaluation	**Weightage**
A **Internship Supervisor's Assessment** *(i) Feedback from the internship supervisor* *- on completion of internship assignment/work (20%)* *(ii) Feedback from the internship supervisor* *- on quality of work in internship assignment/work (10%)* *(iii) Feedback from the internship supervisor* *- internship log book (10%)* *(iv) Feedback from the internship supervisor* *- on attendance, punctuality and work hours (10%)* (For the case of 6-8 week internship done in more than one spell, it will be the average of all the internship supervisors' assessments)	**50%**
B DIEC Assessment *(i) Internship duration (8 /12 weeks) (6/8 weeks online via NPTEL and 2/4 weeks offline) (10% / 10%)* *(ii) Internship Report (20%)* *(iii) Oral Presentation (with PPT) and viva voce (10%)* *(iv) SDG (5%)* *(v) Research Orientation (5%)*	**50%**
Total Weightage:	**100%**

Note: *It is mandatory for the student to appear for oral presentation (with PPT) and viva voce to qualify for course evaluation*

(a) Internship Report: Each student is required to submit a well-documented internship report (both *soft copy and softbound hard copy*) as per format specified by DIEC In case of completing the 6-8 weeks internship in more than one organization, the student shall be required to prepare separate softbound internship reports signed by the internship supervisor (s)along with the seal(s) of the organization(s) The student shall submit two final softbound internship reports along with a soft copy, keeping all the certificate(s) issued by the internship supervisor(s) and all the individual internship reports cleared by the respective internship supervisor Chapter 1 of the final internship report shall clearly describe the following, indicating an overall summary

(i) **Internship(s) attended**: A table with name & address of organization, organization's vision and mission, internship weeks attended, internship period (exact dates attended), internship supervisor, head of the section and head of the organization

(ii) **Duties/tasks during internship(s)**: Table describing name &address of organization, and the duties/tasks undertaken during internships This indicates what opportunities and learning experiences the interns got to get hands-on experience on a wide range of KSQs of a professional engineer

(iii) **Tangible outcomes of internship:** These are the lessons learnt from internship experience The students have to describe in their own words what they learnt from the internship experience The student has to describe what specific KSQs are acquired by him, with reference to the expected internship COs, after successful completion of internship(s) Finally, a table depicting systematic mapping of what they have learnt and the expected internship COs is to be shown

(iv) Student feedback on internship: To gather information on whether the internship was useful and gave practical experience in the chosen field of interest, and other learning, a well-defined feedback questionnaire (*made available by the dept*)with closed and open questions shall be kept in the report

(v) Pictures at the worksite: Student has to keep, in the report, his working pictures at the worksite, discussing with the internship supervisor, the creative project he is working on, or an event he is attending for work, group photo of the team/section/department he worked with

(b) Anti-Plagiarism Check: The internship report should clear the plagiarism check as per the Anti-Plagiarism policy-2020 of the institute

(c) Presentation: Each student should prepare PPT with informative slides and make an effective oral presentation before the DIEC as per the schedule notified by the department The presentation shall compulsorily have slides on the points mentioned in (a)(i)-(v)

(d) It is mandatory for every student to *appear for oral presentation(with PPT) and viva-voce*, to qualify for internship evaluation

(e) A student shall register for supplementary examination for the internship evaluation in the following cases:

(i) absent for oral presentation and viva-voce
(ii) fails to submit the internship report in prescribed format
(iii) fails to fulfill the requirements of internship evaluation as per specified guidelines

(f) Supplementary examination for internship evaluation

(i) The CoE shall send the list of students registered for supplementary examination to the HoD concerned

(ii) The DIEC, duly constituted by the HoD, shall conduct the internship evaluation supplementary exam and send the award list to the CoE within the stipulated time

Course Articulation Matrix (CAM):		U24IN707: INTERNSHIP EVALUATION												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24IN707.1	1	2	1	1	3	-	1	3	1	3	2	2	2
CO2	U24IN707.2	3	2	1	1	3	-	1	1	1	3	2	2	2
CO3	U24IN707.3	2	2	1	1	3	-	1	1	3	3	2	2	2
CO4	U24IN707.4	2	2	1	1	3	-	1	1	1	3	2	2	2
U24IN707		2	2	1	1	3	-	1	1.75	1.5	3	2	2	2
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	CO Statement (The student should be able to…)	Relevant SDG	SDG Description	Mapping Justification
CO1	demonstrate understanding of professional practices, workplace ethics, and organizational functioning through internship experience	SDG 4	Quality Education	Industrial internship provides experiential learning in ECE domains such as Embedded Systems, IoT, VLSI, Communication Systems, Signal Processing, Artificial Intelligence, and Semiconductor Technologies Students acquire practical skills, industry exposure, professional networking opportunities, and lifelong learning abilities, thereby strengthening quality technical education and employability
CO2	apply engineering knowledge and modern tools to perform assigned tasks and solve real-world problems	SDG 11	Sustainable Cities and Communities	Effective communication and collaboration are essential for multidisciplinary ECE projects such as smart city infrastructure, intelligent transportation systems, public safety networks, and digital communication platforms that contribute to sustainable and connected communities
CO3	exhibit professional skills including communication, teamwork, leadership, and lifelong learning	SDG 9	Industry, Innovation and Infrastructure	Application of ECE concepts to industrial problems through communication networks, embedded systems, IoT, VLSI, robotics, AI-enabled systems, and automation technologies promotes innovation, industrial modernization, and sustainable infrastructure development
CO4	prepare internship reports and effectively communicate internship outcomes through presentations and viva-voce	SDG 12	Responsible Consumption and Production	Professional ethics, quality assurance, responsible technology deployment, resource optimization, and sustainable engineering practices in ECE industries encourage responsible production, efficient use of resources, and continuous improvement

MAJOR PROJECT PHASE 1			
Class: B. Tech. VII – Semester		**Branch:** CSE(IoT)	
Course Code:	**U24IN708**	**Credits:**	**1**
Hours/Week (L-T-P- E):	**0-0-8-8**	**CIE:**	**100%**
Total Number of Teaching Hours:	**-**	**ESE:**	

Course Learning Outcomes (COs):

After completion of this course, the students should be able to,

CO1: review research literature, identify gaps in the literature, formulate problem, apply knowledge of mathematics, sciences, engineering fundamentals, experimental and data analysis techniques, synthesize technical knowledge and innovative approaches to generate suitable solutions for real- world complex engineering problems (**Technical skills**)

CO2: design a system or product based on product/customer specifications, develop, analyze, and critically evaluate the design alternatives in order to justify the solutions to a real-world problem guided by ethical, environmental, societal and sustainable development considerations, use modern engineering and IT tools to design, build and test a prototype within specified project timeline and budget (**Problem solving and critical thinking skills**)

CO3: apply project management and organizational skills, demonstrate integrity, leadership, creativity, professional and ethical responsibilities as an individual and as a member or leader to produce time-sensitive deliverables in a multi-disciplinary team (**Ethics and teamwork**)

CO4: collate the results, compare performance of prototype to design specifications and present clearly and effectively the proposed solution, conclusions and/or recommendations in written (report, poster, technical paper), oral (presentations) and multimedia formats (video pitch) and engage in self-directed independent learning and life-long learning demonstrating the KSQ of a professional engineer (**Communication skills and life-long learning**)

1. Final Year Major Project work represents the culmination of study towards the B Tech degree ***Major project offers an opportunity to integrate the knowledge acquired from various courses and apply it to solve real-world complex engineering problems*** The **student learning assessment process** (SLAP) shall include good number of presentations, demonstration of work undertaken, submission of a project report, writing project paper in scientific journal style & format, preparing project poster and creating video pitch on the complete project work
2. Activities of major project SLAP shall be planned in such a way to ensure that the students acquire the essential knowledge, skills and qualities (KSQ) of a professional engineer
3. **Team work:** Major project work is a team work
   - **(i)** The students of a project team shall work together to achieve a common objective
   - **(ii)** Every student of a project team is expected to function effectively as an individual, and also with others as a team member in an ecosystem of a team having knowledge diversity, gender diversity, social and cultural diversity among its members
4. **Two phases:** Major project work shall be carried out in two phases Nearly 50 - 75% of the proposed work to be completed in 7thsemester as *Phase-I* and the remaining work to be

continued and completed in 8thsemester as *Phase-II*

5. Every student is expected to put approximately **72hours of work** into the major project *phase-I* course over the 12weeks of 7thsemester

6. Major project work *Phase-I*: 7th semester

(i) The HoD shall constitute the ***department project evaluation committee (DPEC)*** with following composition

Department project evaluation committee (DPEC)	
HoD	Chairman
SeniorFaculty	Convener
Coordinator(s)	Section-wise coordinator(s) *One coordinator for each section*
ThreeFacultymembers	Section-wisefacultymembers *Three faculty members for each section representing various specializations (specializations will be covered including the coordinator's and Convener's)*

(ii) Major project allotment to students during last working week of 6thsemester:

(a) **First / Second week of 6thSemester**: The process shall be initiated during the first / second week of 6thsemester by collecting project titles from the department faculty research groups, on offering innovative ideas/solutions for engineering problems

(b) **MSE-I period of 6th Semester – Notifying project titles**: The finalizedproject titles shall be notified to students during the MSE-I period of 6th semester and student teams shall be allowed to exercise their options on titles that interest them

(c) **Last working week of 6th Semester – Allotment of titles and supervisors to project teams**: The project title allotment to major project teams shall be completed before the last day of instruction of 6th semester

(d) **6th semester summer break - Literature review**: This 6th semester schedule enables students to complete literature review, preliminary simulations / investigations / experimentation during 6th semester summer break and *start the work from day-one in 7thsemester*

(e) **Registration Presentation - Notifying the tentative dates:** The major projectteams are expected to give registration presentation during second / third week from the commencement of 7th semester The tentative dates for conducting the registration presentation shall be notified at the time of releasing the circular on allotted project title and project supervisors, as indicated in (c) above This enables student teams to plan the work accordingly during summer break, to complete the literature review, preliminary simulations / investigations and get ready for informative, confident and comfortable presentations on their project work

(iii) The convener DPEC shall notify, during MSE-I period of 6th semester, the list of implementable project titles offered by the faculty of different research groups of the department

(a) Project titles shall come with the following details to be made available to students on dept webpage and notice boards, facilitating students to select problems that interest them

i. abstract

ii. deliverables / outcomes

iii. knowledge and skills required to complete the project
iv. resources required
v. one of the deliverables shall be writing a technical paper out of the major project work done for submission to a reputed non-predatory conference/non-paid peer reviewed journal

(iv) The major project teams, finalized by the convener DPEC, shall be allowed to exercise their options on the titles that interest them from the notified list

(v) **Project supervisor allotment**: The convener DPEC shall allot, during the last week of 6th semester, the faculty supervisors to all project teams

(a) The project supervisors shall

i. **define project objectives and expected deliverables**
ii. help the students plan their project work and timeline
iii. provide enough resources for successful project completion

(vi) The faculty supervisors are expected to provide guidance to project teams on

(a) *Knowledge, skills and qualities (KSQ) to be acquired* to propose solutions to the identified real-world problems

(b) *Problem analysis* - to identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

(c) Applying engineering knowledge - to applythe knowledgeof mathematics,science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems

(d) *Design/development of solutions* - to design solutions for complex engineeringproblems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental Considerations

(e) *Conduct investigations of complex problems* - to use research-based knowledgeand research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

(f) *Modern tool usage* – to create, select, and apply appropriate techniques,resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations

(g) *The Engineering and the world*– to apply reasoning informed by the contextualknowledge toassess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice

(h) *Ethics* – toapply ethicalprinciples andcommit toprofessional ethics,responsibilities, and norms of the engineering practice

(i) *Individual and team work* – to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

(j) *Communication* – to communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

(k) *Project management and finance* – to demonstrate knowledge and understandingof the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

(l) *Life-long learning* – to recognize the need for, and have the preparation andability to engage in independent and life-long learning in the broadest context of

technological change

(vii) The project supervisors are also expected to continuously emphasize and guide students on

(a) Meeting Cadence:

i. **Regular meetings with supervisor:** Short and frequent meetings increasea team's work momentum Regular meetings with supervisor to review the status of project are very essential All students of the team shall participate in discussions and take notes

ii. **Meeting Frequency: Semi-weekly cadence,** ie, the meeting frequency shall be **twice a week** Due weightage will be given to meeting cadenceand considered for evaluation during presentations, ie, number of planned meetings and number attended by students

(b) **Project Log Book:** The activity journaling in project log book is veryimportant for a successful project

i. Project log book is a written record showing the daily project activity on project goals from the very first thing like starting the project (an introduction statement what the project is all about), to the completion of the work (including the final results, and whether project met the core objectives / outcomes, etc)

ii. In project log book, the activities like regular meetings with project supervisor, and work carried out on daily/weekly basis are to be recorded This ensures that the student progress is being monitored well

iii. The project supervisor shall regularly check the log book of every student of project team and endorse each and every activity by affixing his signature with date With this, the number of planned meetings and number attended by the students will be also monitored

iv. Log books are to be shown during all presentations and will be graded along with the project

v. At the conclusion of the project work *phase-I*, the supervisor shallspecifically comment, in the project log book, on whether the project team met each of the project work *phase-I* goals and to give evidence which describes the quality of work For project teams, this also serves as self-assessment

(c) **Following project timeline**: completing the tasks as planned in project timeline

(d) The relevant knowledge, skills and qualities (**KSQ**) an engineering graduate should possess, which can be specially acquired by participating in major project work

(e) **Writing down whatever is done and making notes of whatever is read** Writing down the procedures/models followed, designs made, experiments conducted, simulations carried out, intermediate results obtained, ***difficulties faced and how they were fixed*** are very important This kind of documenting the whole process as we go with project implementation is a very effective way and will help preparing a well- documented report having original content Note down and include information about all the resources that you used, magazines, Journals, patents, books, and so on. This information will be needed for the bibliography in your project report On the other hand, documenting a report ***on the spur of the moment*** would end up copying things from other sources resulting in a plagiarized document

(f) **Good and sufficient literature review**: Literature review is a description and analysis of information related to the topic of project work Reading good number

of review articles, research articles published in recent issues of peer reviewed journals, technical magazines, patents, reference books on the topics of potential interest, will help one understand what has already been discovered and what questions remain to identify gaps in the literature

(g) Completing nearly 50 - 75% of the proposed work during phase-I

(h) Right conduct of research to promote academic integrity, honesty and time management

(i) Preparing a well-documented report in proper format, covering the progress made during Phase-I

(j) Consequences of plagiarism and use of anti-plagiarism software to detect plagiarism in documents

(k) Submission of major project phase-I report within acceptable plagiarism levels, as per the ***Anti-plagiarism policy-2020 of our institute***

(l) **Video pitch:** Capturing short videos, photos, screenshots on experimentsconducted, simulations carried out, prototype / working model / process / software package / system developed during course of project execution, photos showing interaction with supervisor for creating a short video pitch on the work done during *phase-I*

(m) **Project Paper**: Writing a technical paper at the end of *phase-II* based on the solution(s) proposed, results obtained, and prototype / working model / process / software package / system developed, for submission to a reputed non-predatory conference/non-paid peer reviewed journal

(n) **Project poster**: At the end of phase-II, the project teams shall have to presenttheir project in the form of posters, at the time of demonstration of complete porotype / working model / software package / system developed

(viii) Phase**– I evaluation**: There shall be only Continuous Internal Evaluation (CIE) for major project work *phase-I* with following components

(a) **Registration Presentation** *(during second / third week of 7th semester):* The Registration Presentation shall include a brief report and presentation focusing the identified problem, objective(s), literature review, identifying research gap in the literature, implementation of existing methods, proposed solution, and expected outcome(s)

i. The registration presentation shall invariably include the **project plan timeline** with actual start and finish dates– monthly/weekly project milestones/ timeline prepared in MS Excel or any other project management tool

ii. **Project timeline –** *Weekly project milestones*: It's a compact and creative way to present a project plan Identify the project intermediate goals and related tasks for completing each of those goals Categorize tasks for each week In the project timeline use different colors to the tasks for each week Horizontal timeline layouts shall be preferred or any other layout of team's choice

iii. Project teams shall create and present the following during registration presentation

1. *Complete project timeline*
2. *Phase-I project timeline*
3. *Phase-II project timeline*

iv. During every presentation, project teams shall compulsorily show the following as part of their presentation

1. *The slides on project timeline and*
2. *A table showing targeted tasks as per timeline and status – whether tasks accomplished?*

v. **Project log book**: Every student of the Project team shall compulsorily show the activity journaling in the log book (*with due signatures of project supervisor*)

during presentations

(b) **Progress Presentation-I** *(during penultimate week of 7th semester):* At the end of first stage (7th semester), student teams shall be required present, before the DPEC, the progress made during phase-I and submit a well-documented report of work done for evaluation to the project coordinator

i. **Following project timeline**: The project timeline shall be meticulouslyfollowed and the tasks shall be completed as planned in the project timeline

ii. Project teams shall compulsorily show the following as part of their progress presentation-I

1. *The slides on project timeline and*
2. *A table showing targeted tasks as per timeline and whether tasks are accomplished?*

iii. **Project log book**: Every student of the Project team shall compulsorily show the activity journaling in the log book (*with due signatures of project supervisor*)

(c) **CIE schedule**: The convener DPEC shall release the complete schedule of CIE before start of 7th semester well in advance, so that student teams will complete the scheduled works and get ready with an informative, confident, and comfortable presentation for registration and progress presentations

(ix) CIE for the Major project work Phase-I shall be as given below:

Major project work Phase-I Assessment *(7th semester)*	**Weightage**
A Supervisor Assessment	**20%**
B. DPEC Assessment *(i) Registration Presentation (10%)* *(ii) Progress Presentation-I (20%)* *(iii) Project progress*: Part of working model/ process/software package/system developed (30%)* *(iii) Well-documented Progress Report on Phase-I work (10%)* *(iv) Video pitch on Phase-I (10%)*	**80%**
Total Weightage	**100 %**

** Students are advised to complete major part of the project in phase-I only*

(a) **Working Model:** Every project team shall be required to develop a working model/ process/software package/system, on the chosen work The progress made in this shall be demonstrated during progress presentation-I at the end of *phase-I* and the completed working model/ process/software package/system before the DPEC as per the dates specified by DPEC at the end of *phase-II*

(b) **Progress Report on *phase-I*:** Every project team shall be required to submit a well-documented progress report on dissertation phase-I as per format specified by DPEC

a **Tangible outcomes of *phase-I* in Conclusions - Chapter:** These are thelessons learnt from doing a project work The students have to describe in their own words what they learnt from the *phase-I* project work experience They have to describe what specific KSQs are acquired by them, with reference to the expected COs, after successful completion of *phase-I* work Finally, a table depicting systematic mapping of what they have learnt and the expected major project work COs, is to be presented in the conclusions chapter of *phase-I* report

(c) **Video pitch on *phase-I*:** Every project team shall be required to create a pitch

video, which is a video presentation on their major project work *phase-I* The project team shall present the produced video pitch during progress presentation-I The produced video pitch should

a. be 3 to 5-minute-long video (no longer than 5 minutes)
b. be concise and to the point, on the problem and proposed solution
c. show project timeline and sample page of log book
d. highlight the progress made at various stages during *phase-I* project implementation with the help of short videos/photos / screenshots on experiments conducted, simulations carried out, part of prototype/ working model/process / software package/system being under development as part of proposed solution and also photos showing team interactions with supervisor and the team working in the lab on project
e. discuss the impact of proposed solution in *ethical, environmental, societal and sustainable development contexts*
f. emphasize key points about *business idea, potential market for the proposed solution*

(x) It is mandatory for

(a) every student of the team to *appear for oral presentation and viva-voce*, as part of progress presentation -I to qualify for course evaluation
(b) every project team *to submit a well-documented progress report on major project work phase-I*, as part of progress presentation -I to qualify for course evaluation
(c) every project team to create and present a good video pitch on major project work*phase-I*, as part of progress presentation -I to qualify for course evaluation

(xi) A student shall register for supplementary examination for the Major project work*phase-I* in the following cases:

(a) He/she is absent for oral presentation and viva-voce as part of progress presentation-I
(b) The project team fails to submit the progress report on *Phase-I* in prescribedformat
(c) The project team fails to submit the video pitch on the progress made during the *phase-I* period
(d) he/she fails to fulfill the requirements of Major project work *phase-I* evaluation as per specified guidelines

(xii) Supplementary examination for Major project work *phase-I*

(a) The CoE shall send the list of students registered for supplementary examination to the HoDs concerned
(b) The DPEC, duly constituted by the HoD, shall conduct Major Project Phase I supplementary exam and send the award list to the CoE within the stipulated time

Course Articulation Matrix (CAM):		U24IN708: MAJOR PROJECT PHASE I												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24IN708.1	3	3	2	3	2	1	1	1	1	1	2	2	2
CO2	U24IN708.2	3	3	3	2	3	3	2	1	1	2	2	2	1
CO3	U24IN708.3	1	1	1	1	1	2	3	3	2	3	1	2	1
CO4	U24IN708.4	1	1	1	2	2	1	2	1	3	1	3	2	2
U24IN708		**2**	**2**	**1.75**	**2**	**2**	**1.75**	**2**	**1.5**	**1.75**	**1.75**	**2**	**2**	**1.5**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement** *(The student should be able to…)*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	review research literature, identify gaps in the literature, formulate problem, apply knowledge of mathematics, sciences, engineering fundamentals, experimental and data analysis techniques, synthesize technical knowledge and innovative approaches to generate suitable solutions for real- world complex engineering problems (technical skills)	**SDG 9**	Industry, Innovation and Infrastructure	Research gap identification, problem formulation, and development of innovative engineering solutions promote technological advancement, industrial innovation, and sustainable infrastructure development in ECE domains such as communication systems, IoT, VLSI, AI, and embedded systems
CO2	design a system or product based on product/customer specifications, develop, analyze, and critically evaluate the design alternatives in order to justify the solutions to a real-world problem guided by ethical, environmental, societal and sustainable development considerations, use modern engineering and it tools to design, build and test a prototype within specified project timeline and budget (problem solving and critical thinking skills)	**SDG 12**	Responsible Consumption and Production	Engineering design considering resource optimization, environmental impact, sustainability, and efficient utilization of technology promotes responsible production and sustainable engineering practices
CO3	apply project management and organizational skills, demonstrate integrity, leadership, creativity, professional and ethical responsibilities as an individual and as a member or leader of a multidisciplinary team	**SDG 11**	Sustainable Cities and Communities	Effective teamwork, ethical engineering practices, leadership, and multidisciplinary collaboration facilitate the development of sustainable technological solutions that improve societal well-being and community infrastructure

CO–SDG Alignment Matrix				
CO	**CO Statement** *(The student should be able to…)*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
		SDG3	Good Health and Well-Being	ECE projects related to biomedical instrumentation, healthcare IoT, telemedicine, wearable sensors, and assistive technologies contribute to improved healthcare services and quality of life
CO4	collate results, compare prototype performance with specifications, communicate findings through reports, posters, technical papers, presentations, and video pitches, engage in self-directed and lifelong learning	**SDG 4**	Quality Education	Technical communication, dissemination of knowledge, professional documentation, and lifelong learning foster continuous education, skill enhancement, and knowledge sharing among engineering professionals

VIII SEMESTER

S No	Category	Course Code	Course Title	Lectures / week				Credits
				L	T	P	E	C
1	PEC	U24IN801	Program Elective - III / MOOCs-III	2	1	-	3	3
2	PEC	U24IN802	Program Elective - IV / MOOCs-IV	2	1	-	3	3
3	PCC	U24IN803	Cyber Physical Systems	2	1	-	3	3
4	ELC	U24IN804	Major Project, Phase – 2 / Industrial Internship - 2	-	-	12	12	6
Total:				6	3	12	21	15
Additional Learning@:Maximum credits allowed for Honours/Minor				-	-	-	-	4
Total credits for Honours/Minor students:				-	-	-	-	19

Program Elective –III/MOOC-III		
S No	**Course Code**	**Course Title**
1	U24IN801A	Prompt Engineering for Generative AI
2	U24IN801B	Blockchain Technology
3	U24IN801C	Data Mining and Data Warehousing

Program Elective –IV/ MOOC-IV		
S No	**Course Code**	**Course Title**
1	U24IN802A	Reinforcement Learning
2	U24IN802B	Ethical Hacking
3	U24IN802C	R Programming for Data Science

PROMPT ENGINEERING FOR GENERATIVE AI			
Class: B. Tech. VIII – Semester		**Branch:** CSE (IOT)	
Course Code:	**U24IN801A**	**Credits:**	**3**
Hours/Week (L-T-P- E):	**2-1-0-3**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1 : understand the fundamentals of Generative AI, including generative models, deep learning architectures, and their applications in text, image, audio, and video generation

CO2 : analyze the architecture and working principles of autoregressive models, Transformers, GANs, GPT, and BERT for generating intelligent and context-aware outputs

CO3 : apply Variational Autoencoders (VAEs), Diffusion Models, and Flow-based Models to develop generative AI solutions for real-world applications

CO4 : design effective prompts using zero-shot, few-shot, chain-of-thought, and prompt tuning techniques to improve the performance and reliability of Generative AI systems while considering ethical and bias-related issues

UNIT-I	9 Hrs

Generative AI: Introduction to Generative AI, Evolution of Generative AI, Applications in text, image, audio, and video generation, Ethical issues and bias in AI systems

Fundamentals: Latent variable models, Probability distributions and sampling, Optimization techniques, Neural networks, CNNs, Transformer fundamentals

Architectures: Introduction to GANs, VAEs, Autoregressive Models, GPT architectures, Large Language Models (LLMs), Future scope of Generative AI

UNIT-II	9 Hrs

Autoregressive Models: Introductionto autoregressive models, Transformer architecture, Self-attention mechanism, Text generation using autoregressive models, Limitations of autoregressive generation

Generative Adversarial Networks (GANs): GAN architecture, Generator and Discriminator, Variants of GANs, Challenges in GAN training, Mode collapse and instability issues

Large Language Models: Overview of BERT and GPT-2, Introduction to Large Language Models (LLMs), Fine-tuning pre-trained models, Applications of LLMs in real-world tasks

UNIT-III	9 Hrs

Variational Autoencoders (VAEs): Introduction to VAEs, Encoder and Decoder architecture, Latent space representation, Applications of VAEs in unsupervised learning

Advanced VAE Techniques: Conditional VAEs, Disentangled representations, Feature learning using VAEs, Real-world applications of VAEs

Diffusion & Flow-based Models: Introduction to Diffusion models, Image generation using diffusion models, Fundamentals of Flow-based models, Applications of generative diffusion techniques

UNIT-IV	9 Hrs

Prompt Engineering Fundamentals: Introduction to Prompt Engineering, Zero-shot and Few-shot prompting, multi-shot learning, Prompt design principles

Advanced Prompting Techniques: Chain-of-thought prompting, Retrieval-Augmented Generation (RAG), Prompt tuning and evaluation, Error analysis in prompts

AI Tools & Ethical Considerations: Introduction to ChatGPT, DALL·E, Claude, MidJourney, GitHub Copilot, Ethical issues in prompt engineering, Bias mitigation and

responsible AI usage
Textbook: 3. Foster,D(2023)GenerativeDeepLearning:TeachingMachinestoPaint,Write, Compose, and Play (2nd ed) O'Reilly Media, Inc ISBN: 9781098134181
Reference Book(s): 6. Ganguly, K (2020) Learning Generative Adversarial Networks Packt Publishing ISBN: 9781839216350 7. Goodfellow, I, Bengio, Y, & Courville, A (2016) Deep Learning Cambridge, MA: MIT Press ISBN: 9780262035613 8. Langr,J,&Bok,V(2019)GANsinAction:DeepLearningwithGenerative Adversarial Networks Manning Publications ISBN: 9781617295560
Web and Video link(s): *NPTEL Deep Learning – Part 2 (Generative Models) , NPTEL Video Lectures on Deep Generative Models, VAEs, GANs, and Autoregressive Models by Prof Mitesh M Khapra, IIT Madras*

Course Articulation Matrix (CAM):		**U24IN801A: PROMPT ENGINEERING FOR GENERATIVE AI**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24IN801.1**	2	2	1	1	1	-	-	1	-	1	-	2	2
CO2	**U24IN801.2**	2	2	2	2	2	-	-	1	-	1	-	2	2
CO3	**U24IN801.3**	2	2	2	2	3	-	-	1	-	1	-	2	2
CO4	**U24IN801.4**	2	2	2	2	3	-	-	1	-	1	-	2	2
U24IN801A		2	2	2	1.75	2.25	-	-	1	-	1	-	2	2
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	explain the fundamentals of generative ai, generative models, and their applications in various domains	SDG9	Industry, Innovation and Infrastructure	Generative AI technologies promote innovation in industries through intelligent automation, content generation, and advanced AI-driven solutions
CO2	analyze autoregressive models, transformers, gans, gpt, and bert architectures for intelligent content generation	SDG4	Quality Education	Advanced generative models support personalized learning systems, intelligent tutoring, and automated educational content generation
CO3	apply vaes, diffusion models, and flow-based models to develop real-world generative ai applications	SDG9	Industry, Innovation and Infrastructure	Generative models are widely used in healthcare, automation, design, and smart systems, enhancing industrial innovation and research capabilities
CO4	design effective prompts and optimize generative ai systems using prompt engineering techniques while addressing ethical concerns	SDG16	Peace, Justice and Strong Institutions	Ethical prompt engineering and bias mitigation help develop responsible AI systems that ensure fairness, transparency, and trustworthy AI deployment

BLOCKCHAIN TECHNOLOGIES			
Class: B. Tech. VIII– Semester		**Branch:CSE(IoT)**	
Course Code:	**U24IN801B**	**Credits:**	**3**
Hours/Week (L-T-P- E):	**2-1-0-3**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1: distinguish different types of blockchains and consensus algorithms based on their characteristics and use cases

CO2 : apply Bitcoin network and transaction concepts to solve basic cryptocurrency-related problems and assess alternative cryptocurrencies

CO3: apply smart contract principles and Ethereum architecture to develop decentralized applications using blockchain technology

CO4: compare Hyperledger fabric and corda block chain frameworks

UNIT-I	**9 Hrs**

Distributed Systems: Evolution of distributed systems
Distributed Ledger Technology (DLT): Concept of distributed ledgers
Introduction to Blockchain: History of blockchain, electronic cash, generic elements
Structure and Working of Blockchain: Blocks, hashing, linking, architecture, features, benefits and limitations
Types of Blockchain: Public, Private, Consortium, Tokenized, Token-less
CAP Theorem: Concept and intuition
Consensus Mechanisms: Introduction and types

UNIT-II	**9 Hrs**

Cryptographic Foundations of Bitcoin: Asymmetric (public key) cryptography, Public and private keys, Hash functions, Digital signatures (RSA and Elliptic Curve Concepts), Role of cryptography in Bitcoin, Digital Signature
Foundations of Bitcoin: Introduction to Bitcoin, Digital keys, addresses, and Basic cryptography (hashing, digital signatures), Bitcoin transactions (inputs, outputs, UTXO)
Blockchain and Network: Structure of blockchain (blocks, hashing, Merkle tree), Mining and Proof-of-Work,Bitcoin network (nodes, P2P architecture), Transaction lifecycle (creation → validation → confirmation)
Usage and Beyond Bitcoin: Wallets**,** Bitcoin payments and transaction fees, Limitations of Bitcoin
Bitcoin Clients and APIs: Bitcoin installation
Alternative Coins: Litecoin,Z cash

UNIT-III	**9 Hrs**

Smart Contracts Fundamentals: History of smart contracts, Definition and characteristics, Ricardian contracts, Applications of smart contracts
Ethereum: Introduction to Ethereum, Ethereum vs Bitcoin, Ethereum – bird's eye view, Ethereum accounts (EOA and Contract accounts), Ether, Gas and transaction fees
Ethereum Architecture and Network: Ethereum network and nodes, Components of Ethereum ecosystem, Transactions and state changes, Ethereum Virtual Machine (EVM)
Smart Contract Development: Programming languages for Ethereum, Solidity language (basics) Structure of smart contracts
Ethereum Development Environment: Test networks (public testnets), Setting up a private blockchain, Running and managing a private network, Development frameworks
Decentralized Applications and Web3: Introduction to DAO, Introduction to DApps, Web3

introduction	
UNIT-IV	**9 Hrs**
Enterprise Blockchain Platforms: Introduction to enterprise blockchains, Overview of Hyperledger Hyperledger projects (Fabric – basic idea), Hyperledger architecture (reference model – concept) **Corda:** Introduction to Corda, Architecture and components and Corda development environment **Introduction to alternative Blockchain Platforms**: Ripple, Quorum, Multichain, Rootstock, BigchainDB, Storj, Tezos **Blockchain Applications and Industry Landscape:** Real-world implementations of blockchain, Start-ups and industry adoption, Blockchain as a Service (BaaS), Employment opportunities in blockchain **Other challenges:** Regulation, Dark side **Blockchain research:** Smart contracts, Centralization issues, Limitations in cryptographic functions, Consensus algorithms, Scalability and Code obfuscation	
Textbook(s): 1. Imran Bashir, *Mastering Blockchain: Inner workings of blockchain, from cryptography and decentralized identities to DeFi, NFTs and Web3*, Mastering Blockchain, Packt Publishing, 4th edition, 2023, Birmingham, UK (Chapters 1 to 12)	
Reference Book(s): 1. Joseph Bonneau et al, *Blockchain Technology: From Theory to Practice*, Springer, 1st Edition, 2022 *(Chapters 1–8)* 2. Brenn Hill, Samanyu Chopra, Paul Valencourt, *Blockchain Quick Reference*, Packt Publishing, 2018 *(Chapters 1–6)* 3. Kumar Saurabh, Ashutosh Saxena, *Blockchain Technology: Concepts and Applications*, Wiley, 2020 *(Chapters 1–9)*	
Web and Video link(s): https://invideosearchyahoocom/search/video?fr=mcafee&p=NPTEL+BLOCKCHAIN+TECHNOLOGIES+VIDEO&type=E210IN885G0#id=2&vid=0d4dce47729f5f0dccaa1ea877588f56&action=click	

Course Articulation Matrix (CAM):		**U24IN801B:BLOCKCHAIN TECHNOLOGIES**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24IN801B.1**	1	2	2	2	1	-	-	-	-	1	-	1	3
CO2	**U24IN801B.2**	3	3	2	2	1	-	-	-	-	1	-	2	3
CO3	**U24IN801B.3**	3	2	3	2	2	-	-	-	-	1	-	3	3
CO4	**U24IN801B.4**	1	2	3	2	1	-	-	-	-	1	-	2	3
U24IN801B		2	2.25	2.5	2	1.25	-	-	-	-	1		2	3
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	distinguish different types of blockchains and consensus algorithms based on their characteristics and use cases	SDG9	Industry, Innovation and Infrastructure	Understanding blockchain types and consensus mechanisms builds foundational knowledge for developing secure, decentralized digital infrastructure, which is essential for innovation and modern industrial systems
CO2	understand the working of bitcoin, its network, transactions, and explore alternative cryptocurrencies	SDG9	Industry, Innovation and Infrastructure	Bitcoin and cryptocurrencies introduce decentralized financial systems, enabling innovative digital payment infrastructures that enhance financial inclusion and technological advancement
CO3	understand smart contracts, ethereum architecture, and the development of decentralized applications using blockchain	SDG3	Good Health and Well-being	Smart contracts and decentralized applications enable secure healthcare systems such as electronic health records, telemedicine platforms, and automated insurance processing, improving healthcare accessibility and efficiency
CO4	compare hyperledger fabric and corda blockchain frameworks	SDG9	Industry, Innovation and Infrastructure	Enterprise blockchain frameworks like Hyperledger Fabric and Corda support scalable, secure, and efficient industrial applications, strengthening digital infrastructure and fostering innovation in sectors such as supply chain and finance

DATA MINING AND DATA WAREHOUSING			
Class: B. Tech. VIII– Semester		**Branch:** CSE(IoT)	
Course Code:	U24IN801C	**Credits:**	**3**
Hours/Week (L-T-P- E):	**2-1-0-3**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1: demonstrate data warehouse architecture, multidimensional data models, OLAP operations, and preprocessing techniques

CO2 : apply frequent pattern mining and association rule mining algorithms to discover knowledge from datasets

CO3: analyze classification models using suitable performance evaluation techniques

CO4: develop clustering techniques and examine data mining applications in web, finance, and retail domains

UNIT-I	**9 Hrs**

Data Warehouse: Basic concepts, Multitier architecture, Data warehouse models, ETL tools, Metadata repository

Multidimensional Data Modeling: Data cube, Star, Snowflake and Fact constellation schemas, Dimensions, Measures, OLAP operations, Star net query model

Data Warehouse Implementation: Efficient data cube computation, Indexing OLAP, Efficient processing of OLAP queries, OLAP servers

Data Preprocessing: Data cleaning, Integration, Reduction and transformation

UNIT-II	**9 Hrs**

Data Mining: Introduction, Types of data and patterns can be mined, Technologies used, Applications targeted, Major issues in data mining

Association Rule Mining: Basic concepts, Apriori algorithm, Generating association rules from frequent item sets, Improvements of Apriori algorithm, Pattern-Growth approach, Mining frequent Item sets using vertical data format, Mining closed frequent item sets, Correlation analysis, Pattern mining in multilevel and multidimensional space, Constraint based frequent pattern mining

UNIT-III	**9 Hrs**

Classification: Basic Concepts, Classification by decision tree induction, Bayesian classification, Rule based classification, Model evaluation and Selection

Advanced Classification: Classification by back propagation, Associative classification, K Nearest Neighbor classifiers, Rough set and Fuzzy set approaches

UNIT-IV	**9 Hrs**

Cluster Analysis: Introduction, Types of data in cluster analysis, Partitioning methods by K-Means and K-Medoids, Agglomerative versus Divisive hierarchical clustering, BIRCH Multiphase hierarchical clustering, Density based method with DBSCAN algorithm, Grid based method with STING, Evaluation of clusters, Outlier Analysis and detection methods

Data Mining Trends: Mining sequence data, Web data mining, Data mining applications with Finance data analysis, Retail industry and Recommender systems

Textbook:

1. Jiawei Han, Micheline Kamber, *Data Mining Concepts and Techniques*, 3rd ed,

Singapore: Morgan Kaufmann Publishers, 2016 (Chapters: 1 to 10)
Reference Book(s): 1. Sam Anahory, Dennis Murray, *Data warehousing in the real world*, New Delhi: Pearson Education, 2003 2. CSR Prabhu, *Data Warehousing Concepts, Techniques, Products and Applications*, 2nd ed New Delhi: Prentice-Hall of India, 2002 3. Arun K Pujari, *Data Mining Techniques*, 2nd ed Hyderabad: Universities Press, 2010
Web and Video link(s): https://onlinecoursesnptelacin/noc22_ee116/preview, *NPTEL Video Lecture on Data mining by Prof Pabitra MitraIndian Institute of Technology Kharagpur*

Course Articulation Matrix (CAM):		**U24IN801C: DATA MINING AND DATA WAREHOUSING**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24IN801C.1**	2	2	2	2	2	-	-	1	1	1	-	2	1
CO2	**U24IN801C.2**	2	2	2	2	2	-	-	1	1	1	-	2	1
CO3	**U24IN801C.3**	2	2	2	2	2	-	-	1	1	1	-	2	1
CO4	**U24IN801C.4**	2	2	2	2	2	-	-	1	1	1	-	2	1
U24IN801C		2	2	2	2	2	-	-	1	1	1	-	2	1
3 – HIGH, 2 – MEDIUM, 1 – LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	explain data warehouse architecture, multidimensional data models, olap operations, and preprocessing techniques	SDG9	Industry, Innovation and Infrastructure	Data warehousing and preprocessing techniques support intelligent infrastructure, industrial analytics, and efficient data management systems
CO2	apply frequent pattern mining and association rule mining algorithms to discover knowledge from datasets	SDG 8	Quality Education	Knowledge discovery and pattern mining help organizations improve business intelligence, productivity, and decision-making processes
CO3	analyze and evaluate classification models using suitable performance evaluation techniques	SDG 4	Sustainable Cities and Communities	Classification and evaluation models promote analytical thinking, data-driven learning, and advanced computational skills
CO4	implement clustering techniques and examine data mining applications in web, finance, and retail domains	SDG9	Industry, Innovation and Infrastructure	Clustering and domain-specific data mining applications contribute to

REINFORCEMENT LEARNING			
Class: B Tech VIII–Semester		**Branch:**CSE(IoT)	
Course Code:	**U24IN802A**	**Credits:**	**3**
Hours/Week (L-T-P-E):	**2-1-0-3**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1: explain the fundamentals of Reinforcement learning and formulate Markov Decision Processes

CO2: apply Dynamic Programming and Temporal Difference methods to solve reinforcement learning problems

CO3: implement Monte Carlo methods and function approximation techniques for reinforcement learning tasks

CO4: develop Deep Reinforcement Learning models and apply advanced policy-gradient-based approaches to real-world problems

UNIT-I	**9 Hrs**

Fundamentals of Reinforcement Learning: Introduction reinforcement learning framework, Agent–environment interaction, Rewards and return, Markov property Markov decision processes (MDPS), Policies and value functions, Exploration vs exploitation, Applications of reinforcement learning

UNIT-II	9 Hrs

Dynamic Programming and Temporal Difference Learning: Policy evaluation and policy improvement , Policyiteration ,Valueiteration ,Temporal difference (TD) learning ,TD(0) prediction ,SARSAalgorithm ,Q-learning ,ExpectedSARSA, Comparison of dynamic programming and td methods

UNIT-III	9 Hrs

Monte Carlo Methods and function approximation: Montecarloprediction ,Montecarlocontrol ,on-policy and off-policy learning ,Importancesampling ,Function approximation basics ,Linear function approximation ,Featurerepresentation, Neural networks for reinforcement learning

UNIT-IV	9 Hrs

Deep reinforcement learning and advanced topics: Deep Q-networks (DQN) , Experience replay and target networks , Double DQN and duelling DQN, Policy gradient methods Reinforce algorithm, Actor-critic methods, Proximal policy optimization (PPO), Applications in robotics, Gaming, Autonomous systems, and Resource management, I/o operations: I/O basics, reading, writing and copying files using byte and character streams

Textbook(s):

1. Reinforcement Learning: *An Introduction, Richard S Sutton and Andrew G Barto*, MIT Press, 2018
2. Algorithms for Reinforcement Learning, Morgan & Claypool Publishers, 2010

Reference Book(s):

1. Deep Reinforcement Learning Hands-On, Packt Publishing
2. Foundations of Deep Reinforcement Learning, Addison-Wesley

Web and Video link(s):

https://nptelacin/courses/106106143**Reinforcement Learning, IIT Madras**Prof Balaraman Ravindran

Course Articulation Matrix (CAM):		U24IN802A:REINFORCEMENT LEARNING												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN305.1	3	2	1	1	1	-	-	-	-	1	1	2	2
CO2	U24CN305.2	3	3	2	2	2	-	-	-	-	1	1	3	2
CO3	U24CN305.3	3	3	3	2	2	-	-	-	-	1	1	3	3
CO4	U24CN305.4	3	3	3	3	3	-	-	-	-	2	1	3	3
U24CN305		3	2.75	2.25	2	2	-	-	-	-	1.25	1	2.75	2.5
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	explain the fundamentals of reinforcement learning and formulate markov decision processes	SDG4	Quality Education	It promotes advanced knowledge in Artificial Intelligence and Machine Learning, enhancing students' analytical and problem-solving skills and supporting quality technical education
CO2	apply dynamic programming and temporal difference methods to solve reinforcement learning problems	SDG4	Quality Education	It develops computational thinking and algorithmic problem-solving abilities, enabling learners to design intelligent systems and improve their readiness for emerging AI-driven careers
CO3	implement monte carlo methods and function approximation techniques for reinforcement learning tasks	SDG9	Industry, Innovation and Infrastructure	It supports the development of intelligent decision-making systems that can optimize industrial processes, improve automation, and contribute to innovative technological solutions
CO4	develop deep reinforcement learning models and apply advanced policy-gradient-based approaches to real-world problems	SDG9	Industry, Innovation and Infrastructure	It enables the design of advanced AI systems for robotics, autonomous systems, smart infrastructure, and industrial automation, fostering innovation and sustainable technological development

ETHICAL HACKING			
Class: B. Tech. VIII – Semester		**Branch:** CSE (IoT)	
Course Code:	**U24IN802B**	**Credits:**	**3**
Hours/Week (L-T-P- E):	**2-1-0-3**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1 : analyze security vulnerabilities, security models and phases of penetration testing frameworks

CO2 : analyze various cyber attacks and security threats in business and network environments

CO3 : apply reconnaissance, enumeration and exploitation techniques using ethical hacking tools

CO4 : evaluate penetration testing results and recommend suitable mitigation and defense mechanisms

UNIT-I	9 Hrs

Introduction: Hacking impacts, The hacker-Type of hacker, Script kiddies

Framework: Planning the test, Sound operations, Reconnaissance, Enumeration, Vulnerability analysis, Exploitation, Final analysis, Deliverable, Integration

Information Security Models: Computer security, Network security, Service security, Application security, Security architecture

Information Security Program: The process of information security, Component parts of information security programs, Risk analysis and ethical hacking

UNIT-II	9 Hrs

The Business Perspective: Business objectives, Security policy, Previous test results, Business challenges

Planning for a Controlled Attack: Inherent limitations, Imposed limitations, Timing is everything, Attack type, Source point, Required knowledge, Multi-phased attacks, Teaming and attack structure, Engagement planner, The right security consultant, The tester, logistics, Intermediates, Law enforcement

UNIT-III	9 Hrs

Reconnaissance: Social engineering, Physical security, Internet reconnaissance

Preparing for a Hack: Technical preparation, Managing the engagement

Enumeration: Enumeration techniques, Soft objective, Looking around or attack, Elements of enumeration, Preparing for the next phase

Exploitation: Intuitive testing, Evasion, Threads and groups, Operating systems, Password crackers, Rootkits, Applications, Wardialing, Network, Services and areas of concern

UNIT-IV	9 Hrs

Deliverable: The deliverable, The document, Overall structure, Aligning findings,Presentation

Integration: Integrating the results, Integration summary, Mitigation, Defense planning, Incident management, Security policy, Conclusion

Case study: various attacks scenarios and their remedies

Textbook:

1. James S Tiller, *The Ethical Hack: A Framework for Business Value Penetration Testing*, Auerbach Publications, 1st edition, 2019,New York

Reference Book(s):

1. MichaelSimpson,KentBackman,JamesCorley,Hands-On Ethical Hacking and Network Defense, Cengage Learning, 2nd edition, 2005, NewYork
2. Patrick Engebreston, The Basics of Hacking and Penetration testing,: Syngress Publishers, 2011, New York
3. E.C.-Council, *Ethical Hacking and Counter measures: Attack Phases,*Course Technology Press, 2016, New York
4. Hein Smith, HilaryMorrison, *ETHICAL HACKING: A Comprehensive Beginner's Guide to Learn and Master Ethical Hacking,* Kindle Edition, 2018, NewYork

Web and Video link(s):

https://nptelacin/courses/106105217, *NPTEL Video Lecture on Ethical Hacking by Prof Indranil Sengupta, Department of Computer Science and Engineering, IIT Kharagpur*

Course Articulation Matrix (CAM):		U24IN802B: ETHICAL HACKING												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24IN802B.1	2	3	1	2	2	-	2	-	-	-	1	1	1
CO2	U24 IN802B.2	2	3	2	2	2	1	2	-	-	-	1	1	2
CO3	U24 IN802B.3	2	2	2	2	3	-	1	1	-	-	1	2	2
CO4	U24 IN802B.4	2	3	3	2	2	2	2	-	1	-	2	2	2
U24 IN802B		2	2.75	2	2	2.25	1.5	1.75	1	1	-	1.25	1.5	1.75
3 – HIGH, 2 – MEDIUM, 1 – LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	analyze security vulnerabilities, security models and phases of penetration testing frameworks	SDG9	Industry, Innovation and Infrastructure	Analysis of security vulnerabilities and penetration testing frameworks supports the development of secure and resilient digital infrastructure for industrial and communication systems
CO2	analyze various cyber attacks and security threats in business and network environments	SDG16	Peace, Justice and Strong Institutions	Understanding cyber attacks and security threats helps in protecting information systems and ensuring secure and trustworthy digital environments
CO3	apply reconnaissance, enumeration and exploitation techniques using ethical hacking tools	SDG9	Industry, Innovation and Infrastructure	Application of ethical hacking and reconnaissance tools enables proactive identification of system vulnerabilities, supporting reliable and secure computing infrastructure
CO4	evaluate penetration testing results and recommend suitable mitigation and defense mechanisms	SDG11	Sustainable Cities and Communities	Evaluation of penetration testing results and implementation of defense mechanisms contribute to securing smart systems, communication networks and digital services in modern communities

R PROGRAMMING FOR DATASCIENCE

Class: B. Tech. VIII – Semester		**Branch:** CSE (IoT)	
Course Code:	**U24IN802C**	**Credits:**	**3**
Hours/Week (L-T-P- E):	**2-1-0-3**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1 : apply R programming fundamentals and statistical concepts for data analysis

CO2 : manipulate and organize data using R data structures for effective data processing

CO3 : develop R programs using functions, control structures, and packages to solve data science problems

CO4 : perform data visualization and predictive analysis using statistical and machine learning techniques in R

UNIT-I	**9 Hrs**

Introduction to Data Science: Definition of Data Science, Big Data and Data Science, Datafication, Data Science Lifecycle, Statistical Inference, Population and Sample, Probability Distributions, Statistical Modeling, Model Fitting, Overfitting and Underfitting

Introduction to R: Features of R, R Environment Setup, RStudio IDE, Variables, Operators, Input and Output Functions, Basic Data Types, Type Conversion, Data Import and Export

UNIT-II	**9 Hrs**

Types of Data and Attributes: Nominal, Ordinal, Binary, Numeric, Discrete and Continuous Attributes

Statistical Description of Data: Measures of Central Tendency - Mean, Median, Mode, Measures of Dispersion - Range, Quartiles, Variance, Standard Deviation, Interquartile Range

R Data Structures: Vectors, Vector Operations and Subsetting, Matrices, Arrays, Factors, Data Frames, Data Manipulation, Sorting and Filtering Data, Lists and List Operations

UNIT-III	**9 Hrs**

Conditional Statements: Relational Operators, Logical Operators, If, If-Else, Nested If Statements

Iterative Programming: While Loop, For Loop, Loop Control Statements, Looping Through Vectors, Lists and Data Frames

Functions in R: User Defined Functions, Function Arguments, Nested Functions, Scope Rules, Recursive Functions, Package Installation and Loading, Mathematical and Statistical Functions

Data Wrangling using R Packages: Introduction to dplyr, tidyr and stringr packages

UNIT-IV	**9 Hrs**

Data Visualization: Pie Charts, Bar Charts, Histograms, Box Plots, Line Charts, Scatter Plots, Multiple Line Graphs, Data Visualization using ggplot2

Regression Analysis: Simple Linear Regression, Multiple Linear Regression, Model Evaluation Metrics

Introduction to Machine Learning in R: Data Preparation, Training and Testing Datasets, Classification Concepts, Predictive Analytics Applications in Data Science

Case Studies: R for Business Analytics, Healthcare Analytics and IoT Data Analysis

Textbook(s):

1. Cathy O'Neil and Rachel Schutt, *Doing Data Science: Straight Talk from the Frontline*, Sebastopol: O'Reilly Media, 2014 (Chapters 1–6)
2. K.G. Srinivasa and G.M. Siddesh, *Statistical Programming in R*, New Delhi: Oxford University Press, 2018 (Chapters 1–12)

Reference Book(s):

1. Hadley Wickham and Garrett Grolemund, *R for Data Science: Import, Tidy, Transform, Visualize, and Model Data*, Sebastopol: O'Reilly Media, 2017
2. Norman Matloff, *The Art of R Programming: A Tour of Statistical Software Design*, San Francisco: No Starch Press, 2011
3. Jared P. Lander, *R for Everyone: Advanced Analytics and Graphics*, Boston: Addison-Wesley Professional, 2nd Edition, 2017
4. Roger D Peng, *R Programming for Data Science*, Lean Publishing, 2016
5. Rafael A. Irizarry, *Introduction to Data Science: Data Analysis and Prediction Algorithms with R*, Boca Raton: CRC Press, 2019
6. Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani, *An Introduction to Statistical Learning with Applications in R*, New York: Springer, 2nd Edition, 2021

Web and Video link(s):

1. https://nptelacin/courses/111104146, NPTEL course by Prof Shalabh, IIT Khanpur

Course Articulation Matrix (CAM):		**U24IN802C: R PROGRAMMING FOR DATASCIENCE**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24IN802C.1**	2	2	1	1	2	-	-	1	-	-	-	2	2
CO2	**U24IN802C.2**	2	3	2	1	2	-	-	1	1	-	-	2	2
CO3	**U24IN802C.3**	2	3	2	2	2	-	-	1	1	-	-	2	2
CO4	**U24IN802C.4**	2	3	3	2	3	-	-	1	2	1	1	3	2
U24IN802C		2	**2.75**	**2**	**1.5**	**2.25**	**-**	**-**	**1**	**1**	**1**	**1**	**2.25**	**2**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement** *(The student should be able to…)*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	apply R programming fundamentals and statistical concepts for data analysis	SDG 4	Quality Education	Develops computational thinking, statistical reasoning, and data literacy skills essential for modern education and lifelong learning
		SDG 9	Industry, Innovation and Infrastructure	Statistical computing and programming provide the foundation for data-driven innovation and digital transformation across industries
CO2	manipulate and organize data using R data structures for effective data processing	SDG 9	Industry, Innovation and Infrastructure	Efficient data management and processing are key requirements for building intelligent systems and digital infrastructures
		SDG 12	Responsible Consumption and Production	Proper handling, processing, and management of data support efficient resource utilization and informed decision-making
CO3	develop R programs using functions, control structures, and packages to solve data science problems	SDG 4	Quality Education	Enhances problem-solving, programming proficiency, and analytical skills through practical implementation
		SDG 8	Decent Work and Economic Growth	Programming and data analytics skills improve employability and support workforce readiness in the data-driven economy
CO4	perform data visualization and predictive analysis using statistical and machine learning techniques in R	SDG 9	Industry, Innovation and Infrastructure	Data analytics and predictive modeling drive innovation, intelligent decision-making, and technology-enabled solutions
		SDG 3	Good Health and Well-being	Predictive analytics can be applied in healthcare for disease prediction, patient monitoring, and evidence-based decision-making
		SDG 11	Sustainable Cities and Communities	Data visualization and analytics support smart city applications, urban planning, and sustainable community development

CYBER PHYSICAL SYSTEMS			
Class: B. Tech. VIII – Semester		**Branch:** CSE (IOT)	
Course Code:	**U24IN803**	**Credits:**	**3**
Hours/Week (L-T-P- E):	**2-1-0-3**	**CIE:**	**60%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**40%**

Course Learning Outcomes (COs)

After completion of this course, the students should be able to,

CO1 : elaborate cyber physical systems and its applications

CO2 : analyze the safety requirements of cyber physical systems and its models

CO3 : analyze the Asynchronous design primitives in cyber physical systems

CO4 : analyze the applications of cyber physical systems and apply the techniques to ensure security in CPS

UNIT-I	9 Hrs

Cyber-Physical System (CPS): Introduction, Emergence of CPS, CPS drivers, Key features of CPS – Reactive computation, Concurrency, Feedback control of the physical world, Real time computation, Safety critical application, Overview – Formal models, Specification and analysis, Model based design and case studies

Synchronous Model: Reactive components – Variables, Valuations, Expressions, Input, Output, States, Initialization, Update, Executions, Extended state machines, Properties of components – Finite state, Combinational, Event triggered, Non deterministic, Input enabled components, Task graphs and await dependencies, Composing components – Block diagrams, Input/output variable renaming, Parallel composition, Output hiding, Synchronous designs – Synchronous circuits, Cruise control System, Synchronous networks

UNIT-II	9 Hrs

Safety requirements: Safety specifications – Invariants of transition systems, Role of requirements in system design, Safety monitors, verifying invariants – Providing invariants, Automated invariant verification, Simulation based analysis, Enumerative search, Symbolic search

Asynchronous Model: Asynchronous processes – States, Inputs, Outputs and Internal actions, Executions,Extendedstate machines, Operations on processes, Safety requirements

UNIT-III	9 Hrs

AsynchronousDesign Primitives: Blocking and non-blocking synchronization, Deadlocks, Shared memory, Fairness assumptions, Asynchronous coordination protocols – Leader election, Reliable transmission, Wait free consensus, Dynamical systems – Continuous time models, Linear systems, Design controllers, Analysis techniques, Time model – Timed processes, Timing based protocol, Hybrid systems – Hybrid dynamical models, Designing hybrid systems

UNIT-IV	9 Hrs

Security of Cyber-Physical Systems: Introduction, Basic techniques, Cyber security requirements, Attack model, Cyber and physical consequences, Counter measures, Advanced techniques, System theoretic approaches

Overview of Cyber-Physical Systems Applications: Introduction and Motivation, System description and operational scenarios, Key design drivers and quality attributes of health

care and medical CPS, Grid and energy CPS, and CPS built on wireless sensor networks
Textbook(s): 1. Rajeev Alur, *Principles of Cyber-Physical Systems*, 2nded,London: MIT Press, 2015 (Chapters 1, 2, 3, 4, 6, 7, 9) 2. Raj Rajkumar, Dionisio de Niz and Mark Klein, *Cyber-Physical Systems*, 1st ed, New Delhi: Addison-Wesley, 2017 (Chapters 1, 7)
Reference Book(s): 1. E A Lee and S A Seshia, *Introduction to Embedded Systems: A Cyber-Physical Systems Approach*, 2nd ed, New Delhi: PHI Learning, 2019 2. Fei Hu, *Cyber-Physical Systems*, 1st ed, Florida: CRC Press, 2014
Web and Video link(s): NPTEL: Foundations of Cyber Physical Systems — NPTEL Video Lecture on *Foundations of Cyber Physical Systems* by Soumyajit Dey, Professor of CSE, Indian Institute of Technology Kharagpur

Course Articulation Matrix (CAM):		**U24IN803: CYBER PHYSICAL SYSTEMS**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24IN803.1**	2	2	1	1	1	-	-	1	1	1	-	2	2
CO2	**U24IN803.2**	2	2	1	1	1	-	-	1	1	1	-	2	2
CO3	**U24IN803.3**	2	2	1	1	1	-	-	1	1	1	-	3	3
CO4	**U24IN803.4**	2	2	1	1	1	-	-	1	1	1	-	-	3
U24IN803		2	2	1	1	1	-	-	1	1	1	-	2.33	2.5
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	Understand the fundamentals, architecture and models of Cyber Physical Systems	SDG9	Industry, Innovation and Infrastructure	Cyber Physical Systems integrate computation, communication and physical processes to develop intelligent industrial systems, smart manufacturing and modern infrastructure, supporting innovation and sustainable industrial growth
CO2	Apply synchronous and asynchronous models in CPS design and analysis	SDG11	Sustainable Cities and Communities	Synchronous and asynchronous CPS models are widely used in smart transportation, traffic control, automation and smart city applications, enabling efficient and reliable urban services
CO3	Analyze safety, security and verification techniques in Cyber Physical Systems	SDG16	Peace, Justice and Strong Institutions	Synchronous and asynchronous CPS models are widely used in smart transportation, traffic control, automation and smart city applications, enabling efficient and reliable urban services
CO4	Apply CPS concepts in healthcare, energy systems and wireless sensor network applications	SDG3	Good Health and Well-being,	CPS applications in healthcare improve patient monitoring and medical automation, while CPS-based smart grids and energy management systems enhance efficient utilization of clean and sustainable energy resources

MAJOR PROJECT PHASE II			
Class: B. Tech. VIII – Semester		**Branch:** CSE(IoT)	
Course Code:	**U24IN804**	**Credits:**	**6**
Hours/Week (L-T-P- E):	**0-0-12-12**	**CIE:**	**60%**
Total Number of Teaching Hours:	**-**	**ESE:**	**40%**

Course Learning Outcomes (COs):

After completion of this course, the students should be able to,

Upon completion of the major project work, students will be able to…

CO1: review research literature, formulate problem, apply knowledge of mathematics, sciences, engineering fundamentals, experimental and data analysis techniques, synthesize technical knowledge and innovative approaches to generate suitable solutions for real-world complex engineering problems (Technical skills)

CO2: design a system or product based on product/customer specifications, develop, analyze, and critically evaluate the design alternatives in order to justify the solutions to a real-world problem guided by ethical, environmental, societal and sustainable development considerations, use modern engineering and IT tools to design, build and test a prototype within specified project timeline and budget (Problem solving and critical thinking skills)

CO3: apply project management and organizational skills, demonstrate integrity, leadership, creativity, professional and ethical responsibilities as an individual and as a member or leader to produce time-sensitive deliverables in a multi-disciplinary team (Ethics and teamwork)

CO4: collate the results, compare performance of prototype to design specifications and present clearly and effectively the proposed solution, conclusions and/or recommendations in written (report, poster, technical paper), oral (presentations) and multimedia formats (video pitch) and engage in self-directed independent learning and life-long learning demonstrating the KSQ of a professional engineer (Communication skills and life-long learning)

1. **Major project work shall be continued in 8thsemester as major project *phase-II*:** All the major project teams shall take the *phase -I* work forward and complete the remaining work as *Phase-II* in the 8thsemester
2. Final Year Major Project work represents the culmination of study towards the B Tech degree Major project offers an opportunity to integrate the knowledge acquired from various courses and apply it to solve real-world complex engineering problems The student learning assessment process (SLAP) shall include good number of presentations, demonstration of work undertaken, submission of a project report, writing project paper in scientific journal style & format, preparing project poster and creating video pitch on the complete project
3. Activities of major project SLAP shall be planned in such a way to ensure that the students acquire the essential knowledge, skills and qualities (KSQ) of a professional engineer
4. **Team work:** Major project work is a team work
   (i) The students of a project team shall work together to achieve a common objective
   (ii) Every student of a project team is expected to function effectively as an individual, and also with others as a team member in an ecosystem of team having knowledge diversity, gender diversity, social and cultural diversity among its members
5. Every student is expected to put approximately **168 hours of work** into the major

projectphase-IIcourse over the 12 weeks of 8thsemester

6. **Major project work *Phase-II*: 8thsemester**

(i) The convener DPEC shall release complete schedule of *phase-II* CIE during last week of 7thsemester (*well in advance before start of 8thsemester*), immediately after completion of Progress Presentation-I, so that student teams would complete the scheduled works during inter-semester break and get ready with informative, confident and comfortable presentation for progress presentation-II

(ii) The project supervisors: The project supervisors are expected to guide the students to systematically continue the phase-I work, useful work during inter- semester break, meeting the deadlines as proposed in project timeline

(iii) The project supervisors shall ensure students focus on the project objectives and expected deliverables

(iv) The project supervisors shall ensure students have sufficient resources for successful project completion

(v) The project supervisors shall ensure students have sufficient resources for successful project completion

(vi) The project supervisors shall continue guiding students on

(a) *Knowledge, skills and qualities (KSQ) of a professional engineer to be acquired* to propose solutions and design the systems to theidentified real-world problems

(b) *Problem analysis* -to identify, formulate, reviewresearch literature, andanalyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

(c) *Applying engineering knowledge* - to applythe knowledgeof mathematics,science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems

(d) *Design/development of solutions* - to design solutions for complex engineeringproblems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental Considerations

(e) *Conduct investigations of complex problems* - to use research-based knowledgeand research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

(f) *Modern tool usage* – to create, select, and apply appropriate techniques,resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations

(g) *The Engineering and the world*– to apply reasoning informed by the contextualknowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice

(h) *Ethics* – to applyethical principlesand committo professional ethics,responsibilities, and norms of the engineering practice

(i) *Individual and team work* – to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

(j) *Communication* – to communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able

to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

(k) *Project management and finance* – to demonstrate knowledge and understandingof the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

(l) *Life-long learning* – to recognize the need for, and have the preparation andability to engage in independent and life-long learning in the broadest context of technological change

(vii) The project supervisors are also expected to continuously emphasize and guide the students on

(a) **Following project timeline**: completing the tasks as planned in projecttimeline

(b) **Meeting Cadence:**

i. **Regular meetings with supervisor:** Short and frequent meetings increase a team's work momentum Regular meetings with supervisor to review the status of project are very essential All students of the team shall participate in discussions and take notes

ii. **Meeting Frequency: Semi-weekly cadence,** ie, the meeting frequency shall be **twice a week** Due weightage will be given to meeting cadence and considered for evaluation during presentations,ie, number of planned meetings and number attended by students

(c) **Project Log Book:** The activity journaling in project log book is very important for a successful project

i. Project log book is a written record showing the daily project activity on project goals from the very first thing like starting the project (an introduction statement what the project is all about), to the completion of the work (including the final results, and whether project met the core objectives / outcomes, etc)

ii. In project log book, the activities like regular meetings with project supervisor, and work carried out on daily/weekly basis are to be recorded This ensures that the student progress is being monitored well

iii. The project supervisor shall regularly check the log book of every student of project team and endorse each and every activity by affixing his signature with date With this, the number of planned meetings and number attended by the students will be also monitored

iv. Log books are to be shown during all presentations and will be graded along with the project

v. At the conclusion of the project work *phase-II*, the supervisor shallspecifically comment, in the project log book, on whether the project team met each of the project work outcomes and to give evidence which describes the quality of work For project teams, this also serves as self-assessment

(d) **Writing down whatever is done and making notes of whatever is read** Writing down the procedures / models followed, designs made, experiments conducted, simulations carried out, intermediate results obtained, ***difficulties faced and how they were fixed*** are very important This kind of documenting the whole process as we go with project implementation is a very effective

way and will help preparing a well- documented report having original content Note down and include information about all the resources that you used, magazines, Journals, patents, books, and so on This information will be needed for the bibliography in your project report On the other hand, documenting a report ***on the spur of the moment*** would end upcopying things from other sources resulting in a plagiarized document

(e) The relevant knowledge, skills and qualities (**KSQ**) an engineering graduate should possess, whichcan bespecially acquiredby participating in major project work

(f) **Good and sufficient literature review**: Literature review is a description and analysis of information related to the topic of project work Reading good number of review articles, research articles published in recent issues of peer reviewed journals, technical magazines, patents, reference books on the topics of potential interest, will help one understand what has already been discovered and what questions remain to identify gaps in the literature

(g) Completing the proposed work by the end of *phase-II*

(h) Right conduct of research to promote academic integrity, honesty and time management

(i) Preparing a well-documented overall project report in proper format, covering the complete work carried out during both the phases (*phase-I and phase-II*)

(j) Consequences of plagiarism, and use of anti-plagiarism software to detect plagiarism in the report

(k) Submission of major project work report within acceptable plagiarism levels (including AI Plagiarism), as per the ***Anti-plagiarism policy-2020 of our institute***

(l) **Video pitch on complete project work**: Capturing short videos, photos, screenshots on experiments conducted, simulations carried out, prototype / working model / process / software package / system developed during course of project execution, photos showing interaction with supervisor for creating a short video pitch on the complete work done during both phases (*phase-I and phase-II*)

(m) **Project Paper**: Writing a technical paper at the end of *phase-II* based on the solution(s) proposed, results obtained and prototype / working model / process / software package / system developed, for submission to a reputed non-predatory conference/non-paid peer reviewed journal

(n) **Project poster**: At the end of phase-II, the project teams shall have to present their project in the form of posters, at the time of demonstration of complete porotype / working model / software package / system developed

(viii) **Phase – II evaluation**: There shall be only Continuous Internal Evaluation (CIE) for major project work *phase-I* with following components

(a) **Progress Presentation -II** *(during third / fourth week of 8thsemester):* The progress presentation-II shall include the identified problem, objective(s), literature review, expected outcome(s), results of work done as per project plan timeline

i. **Following project timeline**: The project timeline shall be meticulouslyfollowed and the tasks shall be completed as planned in project timeline

ii. 80-85% of work is expected to be completed

iii. Project teams shall compulsorily show the following as part of their progress presentation-II

1. *The slides on project timeline and*
2. *A table showing targeted tasks as per timeline and status – whether tasks*

accomplished?

iv. **Project log book**: Every student of the Project team shall compulsorily show the activity journaling in the log book (with due signatures of project supervisor) during presentations

(b) **Final Presentation** *(during penultimate week of 8thsemester):* **Project supervisor shall ensure that the project team has accomplished 100% of work proposed** The project team shall

i. **Follow project timeline**: The project timeline shall be meticulouslyfollowed and the tasks shall be completed as planned in project timeline

ii. compulsorily show the following as part of their final presentation
   1. *The slides on project timeline and*
   2. *A table showing targeted tasks as per timeline and whether all the identified tasks accomplished?*

iii. **show project log book**: Every student of the Project team shall compulsorily show the complete activity journaling in the log book (*with due signatures of project supervisor*)

iv. present complete results & analysis

v. **demonstrate the completed project**: working model / process / software package / system developed

vi. demonstrate the completed project with the **project poster presentation**

(ix) **Evaluation for Major project phase-II:**There shall be continuous internal evaluation (CIE) and end semester examination (ESE) The evaluation for *phase-II* shall be as given below:

Assessment	**Weightage**
A. CIE **(i) Supervisor Assessment (10%)** **(ii) DPEC Assessment (50%)** *(a) Progress presentation-II(10%)* *(b) Final presentation(10%)* *(c) Working model/process/software package/system developed (20%)* *(d) Project video pitch(5%)* *(e) Project paper(5%)*	**60%**
B. ESE *(i) Well-documented project report(15%)* *(DPEC shall evaluate the project reports, as per the rubrics, well before the ESE At the time of ESE, evaluated project report marks shall be posted in the award list,alongwiththe ESE oral presentation marks Students shall appear for Viva-Voce with projectreport)* *(ii) OralpresentationwithPPTsand viva-voce(10%)* *(iii) Project poster(5%)* *(DPEC shall evaluate the project poster, as per the rubrics, well before the ESE At thetimeofESE, evaluated project poster marks shall be posted in the award listStudents shallappearforViva-Voce withprojectposter)* *(iv) SDG (5%)* *(v) Research Orientation (5%)*	**40%**
TotalWeightage	**100%**

(a) **Working Model:** Every project team shall be required to develop a working

model/ process/software package/system on the chosen work The completed working model/ process/software package/system shall be demonstrated during the final presentation at the end of *phase-II*

(b) **Video pitch**: Every project team shall be required to create a pitch video, which is a video presentation on their major project work *phase-I & phase-II* The project team shall present the produced video pitch during Final presentation The produced video pitch should

(i) be 3 to 5-minute-long video (no longer than 5 minutes)

(ii) be concise and to the point, on the problem, proposed solution and its salient features

(iii) show project timeline and sample page of log book

(iv) highlight the various stages during project implementation with the help of short videos / photos / screenshots on experiments conducted, simulations carried out, prototype / working model / process / software package / system developed as part of proposed solution and also photos showing team interactions with supervisor and the team working in the lab on project

(v) discuss the impact of proposed solution in *ethical, environmental, societal and sustainable development contexts*

(vi) emphasize key points about *business idea, potential market for the proposed solution*

(c) **Project poster**: At the end, the project teams shall present their project in the form of posters (A2 size) The teams shall have to present their work during the poster presentation session scheduled at the end of the 8thsemester, at the time of demonstration of complete porotype / working model / software package / system developed

(d) **Well-documented plagiarism-cleared project report**: Every project team shall be required to submit a well-documented project report on the work carried out, as per the format specified by the DPEC The report should clear plagiarism check as per the anti-plagiarism policy-2020 of the institute The following shall compulsorily be included in the Results-Chapter of the project report

(i) Photos / screen shots taken at various stages during the development of working model/ process/software package/system as part of Results-Chapter

(ii) Snapshot of final working model/ process/software package/system developed

(iii) Pictures of the team working in the lab, the team discussing with the project supervisor, working on creative project, or an event they are attending for work

(iv) All *these photos / screen shots shall be properly referred in the project report by assigning figure numbers*

(e) **Tangible outcomes of project work in Conclusions - Chapter:** These are the lessons learnt from doing a project work The students have to describe in their own wordswhat they learnt from the project work experience They have to describe what specific KSQs are acquired by them, with reference to the expected COs, after successful completion of major project work Finally, a table depicting systematic mapping of what they have learnt and the expected major project work COs, is to be shown in the conclusions chapter

(f) **Student feedback on major project in Conclusions - Chapter:** To

gatherinformation on whether project work was useful and gave practical experience on chosen field of interest, and other learning, a well-defined feedback questionnaire (*made available by the dept*) with closed and open questions shall be kept in the conclusions chapter of the project report

(x) It is mandatory for

(a) every student of the team to appear for ESE oral presentation and viva-voce, to qualify for course evaluation

(b) every project team to write a technical paper based on the solution(s) proposed, results obtained and prototype/working model/process/software package/system developed, for submission to a reputed non-predatoryconference/non-paid peer-reviewed journal

(c) every project team shall be required to create a pitch video, which is a video presentation on their major project work phase-I & phase-II

(d) every project team shall present their project in the form of a poster, during the demonstration of complete prototype/working model/software package/system developed

(xi) The student has to register for the Major project work phase-IIas supplementary examination in the following cases:

(a) he/she is absent for oral presentation and viva-voce as part of ESE presentation

(b) he/she fails to fulfill the requirements of Major project work phase-IIevaluation as per specified guidelines

(xii) Supplementary examination for Major project work phase-II

(a) The CoE shall send the list of students registered for supplementary examination to the HoDs concerned

(b) The DPEC, duly constituted by the HoD, shall conduct Major Project Phase-IIsupplementary exam and send the award list to the CoE within the stipulated time

Course Articulation Matrix (CAM):		**U24IN804: MAJOR PROJECT PHASE II**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	U24IN804.1	**3**	**3**	**2**	**3**	**2**	**1**	**1**	**1**	**1**	**1**	**2**	2	2
CO2	U24IN804.2	**3**	**2**	**3**	**2**	**2**	**1**	**2**	**1**	**1**	**2**	**2**	2	1
CO3	U24IN804.3	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**1**	**2**	**2**	**1**	2	1
CO4	U24IN804.4	**1**	**1**	**1**	**2**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	2	2
U24IN804		**2**	**1.75**	**1.75**	**2**	**1.75**	**1.25**	**1.5**	**1**	**1.5**	**1.5**	**1.75**	**2**	**1.5**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement (The student should be able to…)**	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	review research literature, identify gaps in the literature, formulate problem, apply knowledge of mathematics, sciences, engineering fundamentals, experimental and data analysis techniques, synthesize technical knowledge and innovative approaches to generate suitable solutions for real-world complex engineering problems (technical skills)	**SDG 13**	Industry, Innovation and Infrastructure	Research-based innovation and development of advanced IoT solutions contribute to technological progress, industrial growth, and infrastructure development
CO2	design a system or product based on product/customer specifications, develop, analyze, and critically evaluate the design alternatives in order to justify the solutions to a real-world problem guided by ethical, environmental, societal and sustainable development considerations, use modern engineering and it tools to design, build and test a prototype within specified project timeline and budget (problem solving and critical thinking skills)	**SDG 12**	Responsible Consumption and Production	Sustainable design practices, efficient resource utilization, and environmentally responsible engineering solutions promote responsible production and innovation
CO3	apply project management and organizational skills, demonstrate integrity, leadership, creativity, professional and ethical responsibilities as an individual and as a member or leader of a multidisciplinary team	**SDG 11**	Sustainable Cities and Communities	Collaborative development of engineering solutions addressing societal needs contributes to sustainable and resilient communities
CO4	collate the results, compare performance of prototype to design specifications and present clearly and effectively the proposed solution, conclusions and/or recommendations in written (report, poster, technical paper), oral (presentations) and multimedia formats (video pitch) and engage in self-directed independent learning and life-long learning demonstrating the ksq of a professional engineer (communication skills and life-long learning)	**SDG 4**	Quality Education	Technical communication, knowledge dissemination, and self-directed learning support continuous education and professional growth